EXHIBIT 1

LEXSEE 1996 US APP. LEXIS 13330

Analysis
As of: May 31, 2007

Ecolochem, Inc., Plaintiff-Appellant, v. Southern California Edison Company, Defendant-Appellee.

95-1320

UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

1996 U.S. App. LEXIS 13330

June 5, 1996, Decided

NOTICE: [*1] RULES OF THE FEDERAL CIRCUIT COURT OF APPEALS MAY LIMIT CITATION TO UNPUBLISHED OPINIONS. PLEASE REFER TO THE RULES OF THE UNITED STATES COURT OF APPEALS FOR THIS CIRCUIT.

SUBSEQUENT HISTORY: Rehearing Denied and In Banc Suggestion Declined July 30, 1996, Reported at: *1996 U.S. App. LEXIS 20438.* Reported in Table Case Format at: *91 F.3d 169, 1996 U.S. App. LEXIS 37040.*

PRIOR HISTORY: U.S. District Court for the Central District of California. No. CV 92-3436 RG.

DISPOSITION: Affirmed-in-part, reversed-in-part, and remanded for further proceedings not inconsistent with this opinion.

CASE SUMMARY:

PROCEDURAL POSTURE: Plaintiff patent holder appealed a judgment of the U.S. District Court for the Central District of California, which granted defendant corporation's motion for summary judgment in the patent holder's action against the corporation.

OVERVIEW: In the patent holder's action against the corporation, the trial court found that claims in two chemical patents, denoted 492 and 411, were obvious and anticipated. On review, the court concluded that claims in the 492 patent were anticipated by prior art because each and every limitation of the claims was found in a single prior art reference. Additionally, the court held that two claims in the 492 patent were void for obviousness in light of the prior art. However, the court concluded the trial court erred in its analysis determining that a claim of the 411 patent was void for obviousness. In reaching its conclusion, the court held that the trial court failed to properly examine secondary factors that had an effect on the weight given to the prior art when determining whether the claim was obvious.

OUTCOME: The court affirmed the order granting the corporation's motion for summary judgment as to claims of obviousness and anticipation on one patent. However, the court reversed the order granting summary judgment as to obviousness on a second patent.

LexisNexis(R) Headnotes

Civil Procedure > Summary Judgment > Appellate Review > Standards of Review
Civil Procedure > Appeals > Standards of Review > De Novo Review
Patent Law > Infringement Actions > Summary Judgment > Appeals

[HN1] An appellate court reviews a district court's grant of summary judgment de novo, resolving all doubts respecting the presence or absence of genuine factual issues in the nonmovant's favor. In a patent case, proper claim construction is a question of law which the United States Court of Appeals for the Federal Circuit reviews de novo.

Patent Law > Anticipation & Novelty > Elements
[HN2] In patent law, anticipation is shown where each and every limitation of the claimed invention is found in a single prior art reference.

Patent Law > Infringement Actions > Claim Interpretation > General Overview
[HN3] A claim is construed by looking at the language of the claim, other claims in the patent, the specification and, where in evidence, the prosecution history.

Patent Law > Claims & Specifications > Claim Language > Preambles
Patent Law > Infringement Actions > Exclusive Rights > General Overview
[HN4] A patentee may not import additional limitations into the steps of a process claim merely by using the word "comprising" in the claim preamble.

Patent Law > Inequitable Conduct > Effect, Materiality & Scienter > General Overview
Patent Law > Nonobviousness > Elements & Tests > Prior Art
Patent Law > Nonobviousness > Elements & Tests > Secondary Considerations
[HN5] In determining whether a patent's claim is obvious, prior art may affect the weight of the evidence of secondary considerations and vice versa.

JUDGES: Before Newman, Michel and Clevenger, Circuit Judges. Opinion for the court filed by Circuit Judge Michel. Opinion concurring-in-part and dissenting-in-part filed by Circuit Judge Newman.

OPINION BY: Michel

OPINION: Michel, *Circuit Judge*.

Decision

Ecolochem, Inc. (Ecolochem) appeals the summary judgment of the U.S. District Court for the Central District of California, No. CV 92-3436 RG, finding claims 1, 2, 5 and 6 of U.S. Patent No. 4,556,492 (the '492 patent) anticipated, and holding claims 7 and 10 of the '492 patent and claim 20 of U.S. Patent No. 4,818,411 (the '411 patent) obvious. The appeal was submitted for decision after oral argument on December 7, 1995. We affirm the findings of anticipation and the conclusions of obviousness of claims 7 and 10 of the '492 patent, but reverse the conclusion of obviousness **[*2]** of claim 20 of the '411 patent and remand for further proceedings.

I. Background

Ecolochem combined the Houghton process with an ion exchange resin to remove excess hydrazine and carbon contaminants and was awarded two patents based on this invention, the '492 patent and the '411 patent (a continuation of the '492 patent application). As prior art, the examiner cited references to applications of the Houghton process and the known use of hydrazine to deoxygenate liquid. In addition, with respect to the '411 patent, the examiner cited references, including Akol'zin, that teach the use of filters and ion exchange resins to remove liquid contaminants. Claim 1 of the '492 patent reads:

> 1. a deoxygenation process comprising a first step of adding hydrazine to a liquid containing dissolved oxygen, a second step of passing said liquid through a bed of activated carbon to catalyze a reaction between said dissolved oxygen and said hydrazine whereby an amount of dissolved carbon contaminants are added to said liquid, and a third step of passing said liquid through an ion exchange resin selected from the group consisting of mixed bed resin and cation resin to remove at least said dissolved **[*3]** contaminants.

(Claims 2, 5, and 6 are dependent on independent claim 1; claim 7 is dependent on claim 6; claim 10 is dependent on claim 9 which is dependent on independent claim 8.) Claim 1 recites three basic steps: 1) adding hydrazine to a liquid containing dissolved oxygen, 2) catalyzing the reaction between the dissolved oxygen and the hydrazine

using activated carbon, and 3) removing dissolved carbon contaminants with an ion exchange resin. Claim 2 adds a filtration step to remove undissolved carbon contaminants; claim 5 recites the additional removal of unreacted hydrazine through the ion exchange resin; claim 6 limits the liquid of claim 1 to water; claim 8 is similar to claim 1 but requires the removal of excess hydrazine in the third step, not the dissolved carbon contaminants; and claims 7 and 10 add a final step of circulating the deoxygenated water at elevated temperature conditions in a power generating apparatus. Claim 20 of the '411 patent is similar to claim 1 of the '492 patent but omits the first step of the process, taking into account that hydrazine may already be present, and claims the removal of dissolved carbon contaminants with both cation and anion **[*4]** exchange resins in series. On Southern California Edison Co.'s (Edison) motion for summary judgment, the district court found that claims 1, 2, 5 and 6 of the '492 patent are anticipated by Demmitt, a reference not considered by the examiner during prosection of the application leading to the issuance of the patents in suit, and held that, in light of Demmitt, claims 7 and 10 of the '492 patent and claim 20 of the '411 patent are obvious under *35 U.S.C. § 103.* n1 Ecolochem appeals from the judgment based on these findings and conclusions which it challenges.

> n1 Claims 8 and 9 of the '492 patent and claim 21 of the '411 patent were also held anticipated, but these findings are not being appealed.

II. Standard of Review

[HN1] We review the district court's grant of summary judgment *de novo,* resolving all doubts respecting the presence or absence of genuine factual issues in the nonmovant's favor. *Bell Communications Research, Inc. v. Vitalink Communications Corp., 55 F.3d 615, 619, 34 U.S.P.Q.2D (BNA) 1816, 1819 (Fed.* **[*5]** *Cir. 1995).* Proper claim construction is a question of law which we review *de novo. Markman v. Westview Instruments, Inc. 52 F.3d 967, 979, 34 U.S.P.Q.2D (BNA) 1321, 1329 (Fed. Cir. 1995)* (in banc), *aff'd, 116 S. Ct. 1384 (1996).*

III. Anticipation

It is undisputed that the Demmitt reference discloses an application of the Houghton process followed by the use of a cation exchange resin to remove hydrazine from the liquid. The reference does not disclose that carbon contaminants are added to the liquid by the Houghton process, nor does it indicate the desirability of removing those dissolved carbon contaminants. By its very nature, however, the cation resin removes cationic dissolved carbon contaminants. Furthermore, it is agreed by the parties that most, if not all, carbon sources used in the Houghton process would leach anionic as well as cationic contaminants. [HN2] Since anticipation is shown where each and every limitation of the claimed invention is found in a single prior art reference, *In re Donohue, 766 F.2d 531, 534, 226 U.S.P.Q. (BNA) 619, 621 (Fed. Cir. 1985),* Demmitt anticipates claim 1 if that claim requires only the removal of dissolved cationic carbon contaminants, rather than **[*6]** all of the dissolved carbon contaminants, both cationic and anionic.

[HN3] A claim is construed by looking at the language of the claim, other claims in the patent, the specification and, where in evidence, the prosecution history. *Markman, 52 F.3d at 979, 34 U.S.P.Q.2D (BNA) at 1329.* Claim 1 recites a "deoxygenation process comprising a first step of adding hydrazine . . . a second step . . . [where] carbon contaminants are added . . . and a third step of passing said liquid through an ion exchange resin selected from the group consisting of mixed bed resin and cation resin to remove at least said dissolved contaminants." Ecolochem argues that it is clear from the language of the claim itself, the specification, and the prosecution history of the patent that claim 1 recites a process including a limitation that all dissolved carbon contaminants are to be removed by the ion exchange resin.

Analyzing the language of the claim, we observe that step three of claim 1 is written in the alternative using the Markush format. By claiming a Markush group, Ecolochem has indicated that, for the purpose of claim validity, the members of the claimed group are functionally equivalent. Thus, if utilizing **[*7]** one element of the group is anticipated or obvious, the patentee is precluded from arguing that the claim is valid. *See In re Skoll, 523 F.2d 1392, 1397, 187 U.S.P.Q. (BNA) 481, 484-85 (CCPA 1975).* Accordingly, if either alternative in the Markush group of step three, *i.e.*, employing a cation resin or a mixed bed resin, is anticipated, the entire claim is anticipated.

Demmitt clearly discloses the use of the Houghton process on oxygenated water followed by use of a cation exchange resin. As discussed above, Demmitt meets all the limitations of one of the claimed alternatives in claim 1 of the '492 patent (*i.e.*, using a cation exchange resin to remove dissolved contaminants). Accordingly, it would appear that claim 1 is anticipated by Demmitt.

Ecolochem argues, however, that, despite the recitation of a cation exchange resin as an element of the Markush group, there is a limitation in the claim requiring that all dissolved carbon contaminants be removed. This result can be accomplished, Ecolochem claims, by the use of a mixed bed resin or by the use of a cation resin in combination with an anion resin, and since claim 1 is written using the open-ended term "comprising," the claim **[*8]** should be construed to include the use of additional elements, *i.e.*, addition of an anion resin to follow the cation resin of the second alternative. Placement of "comprising" before recitation of steps, however, results in a "comprising" claim that would cover a process that includes additional steps, not one that uses an additional unrecited element for accomplishing a claimed step. *See Moleculon Research Corp. v. CBS, Inc., 793 F.2d 1261, 1271, 229 U.S.P.Q. (BNA) 805, 812 (Fed. Cir. 1986), cert. denied, 479 U.S. 1030, 93 L. Ed. 2d 829, 107 S. Ct. 875 (1987)* ("While a transitional term such as 'comprising' or, as in the present case, 'which comprises,' does not exclude additional unrecited . . . steps . . . we conclude that the transitional phrase does not . . . affect the scope of the particular structure recited within the method claim's steps.") Thus, all the claim requires, in step three, is that either a mixed bed resin or a cation exchange resin be used *exclusively* to achieve the stated goal of removing dissolved carbon contaminants added in step two. In sum, [HN4] a patentee may not import additional limitations into the steps of a process claim merely by using the word "comprising" in the claim preamble. **[*9]** Accordingly, claim 1 is anticipated by Demmitt. n2

n2 The dissent asserts that "anticipation requires that the patented invention was previously known and is described in a single reference." Dissent at 1. The test for anticipation, however, is not a literal word for word comparison between the prior art and the commercial embodiment of the patentee's invention; the test is whether "each and every element *as set forth in the claim* is found, either expressly or inherently described, in a single prior art reference." *Constant v. Advanced Micro-Devices, Inc., 848 F.2d 1560, 1570, 7 U.S.P.Q.2D (BNA) 1057, 1064 (Fed. Cir. 1988)* (emphasis added); *Glaverbel Societe Anonyme v. Northlake Marketing & Supply, Inc., 45 F.3d 1550, 1554, 33 U.S.P.Q.2D (BNA) 1496, 1498 (Fed. Cir. 1995)* ("the claimed process, including each step thereof, must have been described or embodied, either expressly or inherently, in a single reference.") (Newman, J.) (emphasis added); *Standard Havens Prods., Inc. v. Gencor Indus., Inc.,953 F.2d 1360, 1369, 21 U.S.P.Q.2D (BNA) 1321, 1328 (Fed. Cir. 1991)* ("An anticipation reference, however, need not duplicate word for word what is in the claims. Anticipation can occur when a claimed limitation is 'inherent' or otherwise implicit in the relevant reference."). As previously discussed, the cation exchange resin disclosed by Demmitt would inherently remove cationic dissolved contaminants, and the claim, as written, requires no more than the removal of those cationic dissolved contaminants.

Although there is support in the '492 patent specification for a claim that would require the removal of all dissolved contaminants, including anionic contaminants, the applicant did not draft such a claim for the '492 patent. In fact, he did with claim 20 of the '411 patent. *See* discussion on obviousness *infra*. Although we construe limitations narrowly to save the validity of patents, we are precluded from rewriting the patent claim to include unclaimed limitations even where the specification contains adequate support thereof. *See, e.g., Becton Dickinson & Co. v. C.R. Bard, Inc., 922 F.2d 792, 799 n.6, 17 U.S.P.Q.2D (BNA) 1097, 1102 n.6 (Fed. Cir. 1990)* ("Nothing in any precedent permits judicial redrafting of claims.").

[*10]

Because Demmitt clearly discloses the use of water as the liquid to deoxygenate and that the cation exchange resin can be used to remove excess hydrazine, claims 5 and 6 of the '492 patent are anticipated by Demmitt as well. It is unclear why claim 2, which also calls for the

removal of undissolved contaminants, was found to be anticipated by Demmitt. In any event, because Ecolochem fails to distinguish claim 2 from claim 1 for purposes of anticipation, we also affirm the finding on summary judgment that, on the undisputed facts, Demmitt anticipates claim 2. n3

n3 The dissent states that Ecolochem distinguishes claim 2 from claim 1 of the '492 patent for purposes of anticipation by stating that "'claim 2 requires the presence of a fourth filtration step to remove undissolved active carbon contaminants.'" Dissent at 2 (emphasis in original). This statement was made in the background section of Ecolochem's brief for the purpose of listing the claims in suit. In the argument section of its brief, however, Ecolochem asserts that "the anticipation issues center on the interpretation of claim 1 of the '492 patent" and does not distinguish claim 2 as being patentably distinct from claim 1.

[*11]

IV. Obviousness

A. Claims 7 and 10 of the '492 Patent

The district court held claims 7 and 10 of the '492 patent obvious in light of the prior art. Claim 7 is dependent on claim 6, held to be anticipated by Demmitt, and claim 10 is dependent on claim 9, admitted by Ecolochem to be anticipated by Demmitt. Both claims add a final step of circulating the deoxygenated water at the conditions of elevated temperature in a power generating apparatus. The Demmitt reference specifically states that the tests he was conducting were on a system that "would be useful in high temperature reactors." In addition, the 1982 Bechtel reference (Bechtel) discusses the benefits of using carbon catalyzed hydrazine in a PWR steam generator. Accordingly, the district court was correct in concluding that claims 7 and 10 would have been obvious under *35 U.S.C. § 103* in light of Demmitt and Bechtel. n4

n4 The dissent characterizes the majority opinion as holding claims 7 and 10 obvious because the "independent claims from which they depend are 'anticipated,'" thereby accusing the majority of using a patent's claims as "prior art against itself." Dissent at 3. This is inaccurate. Claims 7 and 10 are held obvious in light of Demmitt and Bechtel because they claim a recommended use of the process employed in Demmitt.

In addition, the dissent points out that the process commercially employed by Ecolochem to deoxygenate liquid in a power plant arguably fulfilled a long felt need, was a commercial success, and might not be obvious in light of Demmitt. Dissent at 3-4. However, as discussed *supra*, claims 7 and 10 of the '492 patent fail to recite features employed by Ecolochem in its commercial embodiment. Neither dependent claims 7 and 10, nor independent claims 1 and 8 upon which they respectively depend, require the use of both anionic and cationic resins to remove all dissolved carbon contaminants as employed in Ecolochem's commercial embodiment which forms the basis of Ecolochem's evidence of commercial success. Secondary considerations are only legally relevant where they relate to the patented process, not unclaimed features of a commercial embodiment. *In re Vamco Machine and Tool, Inc., 752 F.2d 1564, 1577, 224 U.S.P.Q. (BNA) 617, 625 (Fed. Cir. 1985)* (court found "no 'secondary considerations' in [that] case having a bearing on the legal issue of the obviousness of the invention" where affidavits extolled the virtues of a commercial embodiment that was different from the claimed invention).

Claims 7 and 10 of the '492 patent recite nothing more than the process taught in Demmitt plus a final step of circulating the deoxygenated water at the conditions of elevated temperature in a power generating apparatus. We agree with the dissent that the proper test for obviousness is not whether a judge sitting today would find the invention obvious. However, it is not "hindsight" to hold as we do that this invention would have been obvious at the time of the application to the ordinary artisan in light of the clear teachings of the prior art and the meaning of the claim as properly interpreted. The environment claimed in claims 7 and 10 is clearly suggested by Demmitt as well as the Bechtel reference. *See* text *supra*.

[*12]

B. Claim 20 of the '411 Patent

The district court also concluded that claim 20 of the '411 patent would have been obvious in light of the other prior art read in conjunction with Demmitt. Claim 20 of the '411 patent recites the same process as claim 1 of the '492 patent except that it begins with hydrazine already in the liquid and it specifies the use of a cation resin in series with an anion resin to remove carbon contaminants. As Demmitt discloses adding the hydrazine, starting with hydrazine already in the liquid is inherently taught by Demmitt. Claim 20 of the '411 patent, as opposed to claim 1 of the '492 patent, however, requires use of both cationic and anionic resins and can be read to require the removal of all dissolved carbon contaminants.

In a prior action, the broader '492 patent had been held not to be invalid for obviousness. *Ecolochem, Inc. v. Mobile Water Tech. Co., 690 F. Supp. 778 (E.D. Ark. 1988), aff'd, 871 F.2d 1096 (Fed. Cir. 1989)* (table) (hereinafter *Mobile Water*). In the present case, the district court found that although prior art before the court in *Mobile Water* did not offer any suggestion to combine the Houghton process with ion **[*13]** resin filtration of contaminants, the Demmitt reference, not before the Arkansas district court, clearly did so. The court below then found that "Demmitt suggests that adding an ion exchange resin to the end of the Houghton process will remove impurities in the effluent."

The district court clearly mischaracterized the import of Demmitt as a prior art reference for the determination of obviousness of claim 20. Demmitt, though anticipating claims 1, 2, 5 and 6 of the '492 patent, did not disclose the removal of carbon contaminants with an ion exchange resin. The only real discussion of the resin is in connection with a formula showing how hydrazine, not dissolved carbon contaminants, can be removed from the liquid. The only "suggestion" made by Demmitt is that it would remove hydrazine, and not other "impurities in the effluent" as stated by the district court. Furthermore, the Akol'zin reference, which does disclose the Houghton process in combination with an ion exchange filter, was cited on the front page of the '411 patent and was thus before the patent examiner, as well as the court in *Mobile Water. 690 F. Supp. at 782.* This reference discloses a process for using hydrazine **[*14]** to deoxygenate a liquid and then filtering the liquid through two filters, "the first containing activated carbon and the second containing an ion exchanger AV-17." Like Demmitt, Akol'zin uses an ion exchange resin to filter the effluent. However, as with Demmitt, the reference "does not teach the use of a mixed bed resin to remove ionic impurities introduced by leaching from the activated carbon." *Id.* Demmitt teaches no more than Akol'zin and is, therefore, merely cumulative.

Despite the district court's mischaracterization of the importance of Demmitt, Ecolochem concedes that there is a "prima facie case of obviousness before Demmitt and there remains one after." However, Ecolochem argues that the secondary considerations, in this case, could rebut the prima facie case and that the district court wrongly failed to consider its evidence of secondary considerations and conclude that the evidence raised a genuine issue of fact requiring trial. We agree.

The district court asserted that "secondary considerations carry little weight where a critical prior art reference has long been neglected," citing *Graham v. John Deere Co., 383 U.S. 1, 36, 15 L. Ed. 2d 545, 86 S. Ct. 684 (1966).* Upon finding that Demmitt **[*15]** was such a critical prior art reference, the district court discounted any effect of the secondary considerations. Contrary to the actions of the district court in this case, however, the court in *Graham* fully evaluated the secondary consideration but found that in those circumstances, the secondary factors failed to "tip the scales of patentability." *Id.* It is not the law that secondary considerations carry little weight, just that [HN5] prior art may affect the weight of the evidence of those considerations and vice versa. In addition, as discussed above, Demmitt, being merely cumulative, is not a "critical" but an uncited ("long neglected") reference. Hence, it adds nothing to the prior art before the patent examiner and the court in *Mobile Water*.

Ecolochem has put forth a large quantity of evidence of secondary considerations to show that the process of its invention was not obvious. Included was evidence: that there was a long-felt, unsolved need in the industry; that many tried but failed to find a solution; that various references taught away from the invention as they warned against the Houghton process because of the carbon contaminants; that customers have been satisfied **[*16]** with Ecolochem's process; that Ecolochem's invention has been widely discussed and favorably received; that

Ecolochem's process has had a large impact on the industry; that others have tried to copy Ecolochem's process; and that Ecolochem has had great commercial success due to the patented invention. These are material facts for determining obviousness which, if found by the fact-finder in favor of Ecolochem, could have tipped the scales to validity as in the *Mobile Water* court.

The district court did not make any findings with respect to the credibility or weight of Ecolochem's evidence regarding secondary considerations, and it would have been improper to do so on summary judgment. Edison, on its part, has put forth evidence to refute Ecolochem's evidence regarding secondary considerations. Accordingly, there are genuine issues of material fact as to secondary considerations that can only be resolved at trial. Only then will the district court be in a position to assess the prior art in light of the secondary considerations to determine whether the prima facie case of obviousness has been overcome.

V. Conclusion

For the foregoing reasons, the trial court's finding of anticipation **[*17]** of claims 1, 2, 5 and 6 of the '492 patent by Demmitt and its holding of obviousness of claims 7 and 10 of the '492 patent, in light of Demmitt, are affirmed, but the trial court's holding of obviousness of claim 20 of the '411 patent is reversed, and the case is remanded for trial on validity and infringement as to claim 20. The judgment of the U.S. District Court for the Central District of California regarding the invalidity of U.S. Patent Nos. 4,556,492 and 4,818,411 is thus affirmed-in-part, reversed-in-part, and remanded for further proceedings not inconsistent with this opinion.

Costs

Each party to bear its own costs.

CONCUR BY: NEWMAN (In Part)

DISSENT BY: NEWMAN (In Part)

DISSENT: NEWMAN, Circuit Judge, concurring in part and dissenting in part.

I write separately to explain why I do not share the view of the panel majority that the '492 patent is invalid.

Anticipation

A finding of anticipation requires that the patented invention was previously known and is described in a single reference. However, my colleagues on this panel have not correctly perceived the technological substance of the Demmitt reference, on which they rely for anticipation. Demmitt reported a **[*18]** scientific study of the Houghton process, whereby he measured the amount of residual hydrazine by taking a sample of the aqueous stream, passing this sample through a cation exchange resin to remove materials that interfere with the measurement of hydrazine, and then measuring the hydrazine content of the sample. This is not the same as the Ecolochem deoxygenation process, wherein carbon catalyst-sourced impurities are removed, as a step in power plant and reactor water deoxygenation, by use of a mixed- or cation-exchange resin.

"Anticipation" means lack of novelty. The Houghton process had languished in disuse until Ecolochem solved the serious problem caused by the carbon-source impurities resulting from that process. Demmitt did not treat or solve that problem. Whatever the relation between Demmitt and the claimed invention, it is not "anticipation," n1 for Demmitt does not disclose the claimed invention.

n1 I do not say that anticipation requires "a literal word for word comparison," as the panel majority states. I do say that anticipation requires that the same invention be described in a single prior art reference. *RCA Corp. v. Applied Digital Data Systems, Inc., 730 F.2d 1440, 1444, 221 U.S.P.Q. (BNA) 385, 388* (Fed. Cir.) ("Anticipation is established only when a single prior art reference discloses, expressly or under principles of inherency, each and every element of a claimed invention."), cert. dismissed sub nom. *Hazeltine Corp. v. RCA Corp., 468 U.S. 1228, 82 L. Ed. 2d 923, 105 S. Ct. 32 (1984).* The Ecolochem claims require treatment of the entire reactor stream, including removing all of the carbon-source contaminants. Demmitt's purification of a small titer for analytical purposes does not meet that criterion, explicitly or inherently.

[*19]

The Houghton process for removal of dissolved oxygen has long been known, but until Ecolochem's

invention disclosed in the '492 patent, the utility of the Houghton process was limited because of the contaminants leached into the water from the carbon catalyst. The publications and other evidence of record show that this problem with the Houghton process was long-standing, and had impeded significant utilization of that process. The record shows that the Ecolochem invention was a widely recognized breakthrough in water purification processes. Demmitt's work twenty-three years earlier was unrelated to the removal of carbon-leached contaminants, as required by claim 1 of the '492 patent.

Nor can the dependent claims be anticipated by a reference that does not describe the added limitations in these claims. Indeed, the panel majority appears to recognize that claim 2 is not anticipated, but casually wipes out claim 2 with the statement that Ecolochem did not distinguish it. That is incorrect, for Ecolochem argued that "claim 2 requires the presence of a fourth filtration step to remove undissolved activated carbon contaminants" (emphasis in original). That step is not even remotely **[*20]** shown, or inherently present, in Demmitt. On no interpretation can Demmitt be found to anticipate claim 2. The panel majority holds that because Ecolochem distinguished claim 2 in only one part of its appellate brief, while stating in another part of the brief that claim 1 presents the central issue, then claim 2 is deemed abandoned on appeal. Claim 2 was not abandoned. It was retained, appealed, and distinguished as appropriate to its subject matter.

Obviousness

The panel majority holds that claims 7 and 10 of the '492 patent would have been obvious because the independent claims from which they depend are "anticipated" by Demmitt. Even if these claims were deemed to be anticipated--as they are not--this ground of "obviousness" is incorrect in law. *35 U.S.C. § 103* requires that obviousness be determined for the invention as a whole, in light of the prior art, not in light of other claims of the same patent. A patent's claims are not prior art against itself. Further, while Ecolochem did not appeal the district court's decision as to all of the claims, that is not an admission as to the non-appealed subject matter. The narrowing of issues on appeal is to be commended, **[*21]** not punished.

Obviousness is determined as of the time the invention was made. The record documents the extensive efforts of others, and the complex procedures that were used by others, to remove dissolved oxygen. Ecolochem cites an early estimate that corrosion-caused replacement and repair costs ranged from $ 50-100 million per year in the United States. J.H. Metcalf, Inhibition and Corrosion Control Practices for Boiler Waters, in Corrosion Inhibitors 196 (C.C. Nathan, ed. 1973). The simple solution discovered by Ecolochem escaped all who came before, and was rapidly embraced and copied by those who came after.

The district court found that there was long-felt need, commercial success, and copying of the Ecolochem invention. Engineers directly involved in this field stated that the Ecolochem process had "unexpected" potential. The record shows the contemporaneous acclaim by persons and even industries that were concerned with the problem of large-scale deoxygenation of water. Indeed, the value of the Ecolochem invention transcended the power plant field; for example, a report praised the Ecolochem process as meeting the water deoxygenation needs of the pulp and paper industry. **[*22]**

It is in this practical milieu that the patent system exists, not the litigation-induced indulgence in hindsight. I can not agree with the panel majority that it would have been both known and obvious to engineers in this field to do what they did not do, to expect what they did not expect, in order to adapt the Houghton process to practical deoxygenation. Demmitt, Bechtel, and others rejected the Houghton process in face of the very problem that Ecolochem showed them how to solve. This is a classical example of misplaced judicial expertise, whereby a breakthrough that was lauded at the time and was accompanied by contemporaneous surprise at how it was accomplished, is now found by judges to have been obvious all along.

Statute and precedent require that obviousness be determined from the viewpoint of a person of ordinary skill at the time the invention was made. Insights to this determination are provided by the record in this case, which shows: (1) Demmitt's rejection of the Houghton process for use at Hanford; (2) competitors' work with a palladium catalyst in order to avoid the problem of impurities from the carbon catalyst; (3) the failure of Bechtel, an engineering giant in **[*23]** this field, and of others, to solve the problem solved by Ecolochem; and of course (4) California Edison's insistence on continuing to

use the Ecolochem process. It is not irrelevant that one of California Edison's engineers stated that "[Ecolochem] saved our ass" and "made heroes out of [names]."

That Ecolochem's solution to the problem of deoxygenation of ambient water in power plants and reactors is retrospectively simple is not the test of the law. Although the panel majority recognizes the important role of objective considerations in its reversal of the summary judgment with respect to the '411 patent, these considerations are also applicable to the '492 patent. The panel majority states at n.4 that the evidence of secondary considerations can not be considered, stating that the claims "fail to recite features employed by Ecolochem in its commercial embodiment." That is incorrect. The affidavits of commercial success and long-felt need relate to the claimed invention. They are powerful evidence in support of the conclusion that the invention was not obvious to a person of ordinary skill.

Thus I must, respectfully, dissent from the panel majority's decision and its analysis **[*24]** of fact and law concerning the '492 patent.

Additional Concerns

I briefly state some additional concerns with the panel majority's discussion of the legal premises of its decision. The majority states that it is no longer necessary to weigh objective evidence such as commercial success along with the other Graham factors; but instead sets this evidence in opposition to the other Graham factors, instructing the district court "to assess the prior art in light of the secondary considerations." That is an incorrect methodology. All evidence must be considered and weighed together, giving each aspect the probative value and credibility that its substance warrants, in determining whether the presumption of validity has been overcome. The contemporaneous views of the engineers who use and understand the technology must be considered along with the prior art, for these views place the invention in the proper context for adjudication.

I do not endorse the rules of claim construction proposed by the majority, for example with respect to the word "comprising." A patentee is not required to place in the claims every detail or step of the total process. It is incorrect **[*25]** to state that Ecolochem's evidence of commercial success does not relate to the patented process but to "unclaimed features," for it is the patented process that is commercially successful. Further, the mixed resin of claim 1 is an anionic/cationic resin.

EXHIBIT 2

Cisco's Pointer Processor

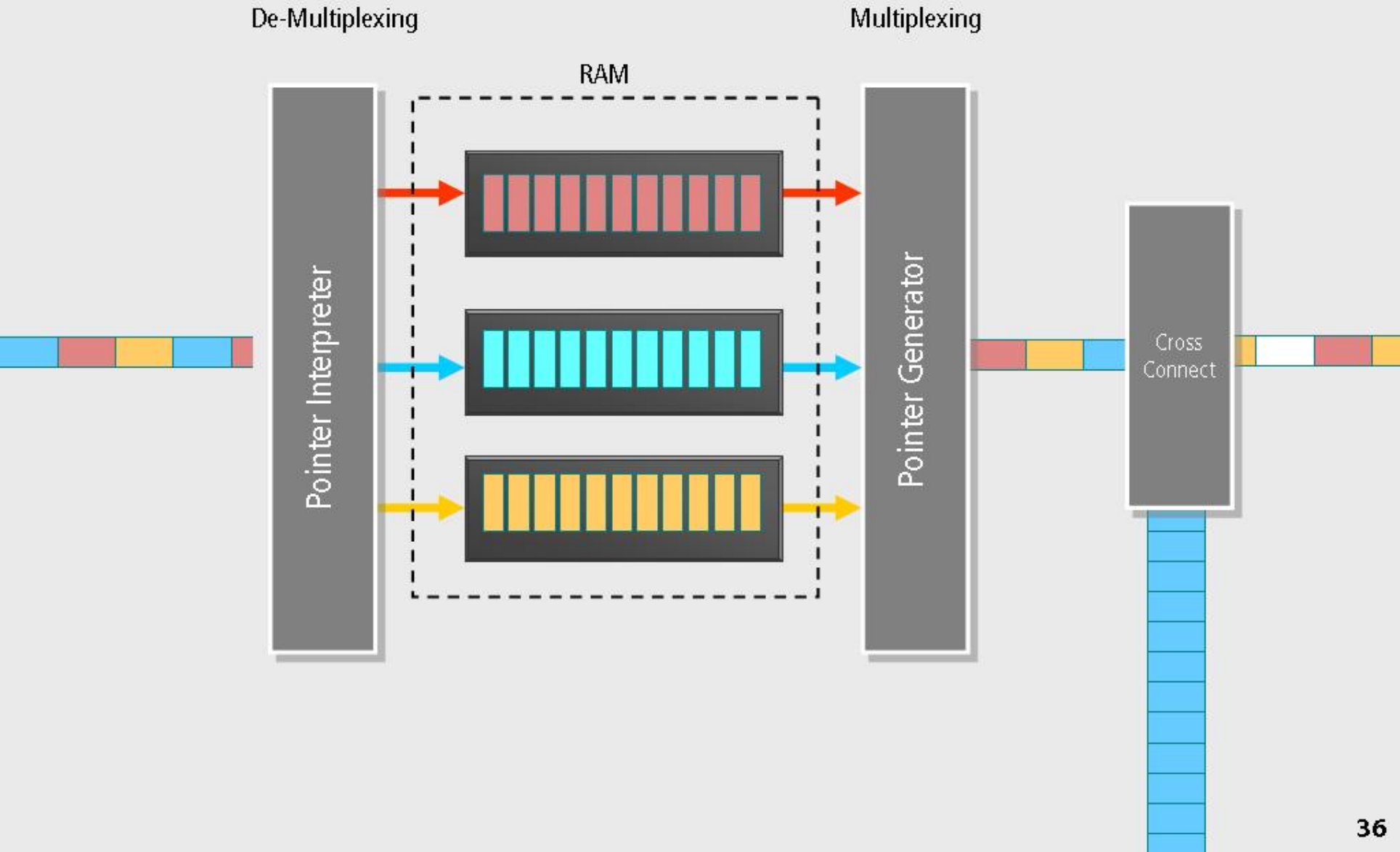


EXHIBIT 3

Block Diagram of Cisco's Products

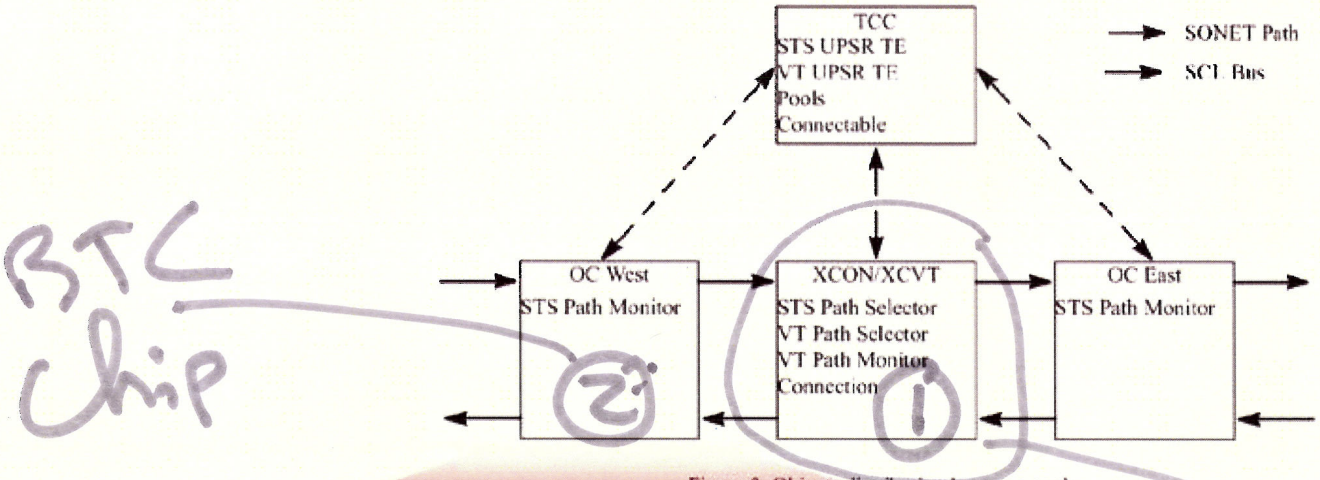


Figure 3. Objects distribution between cards.

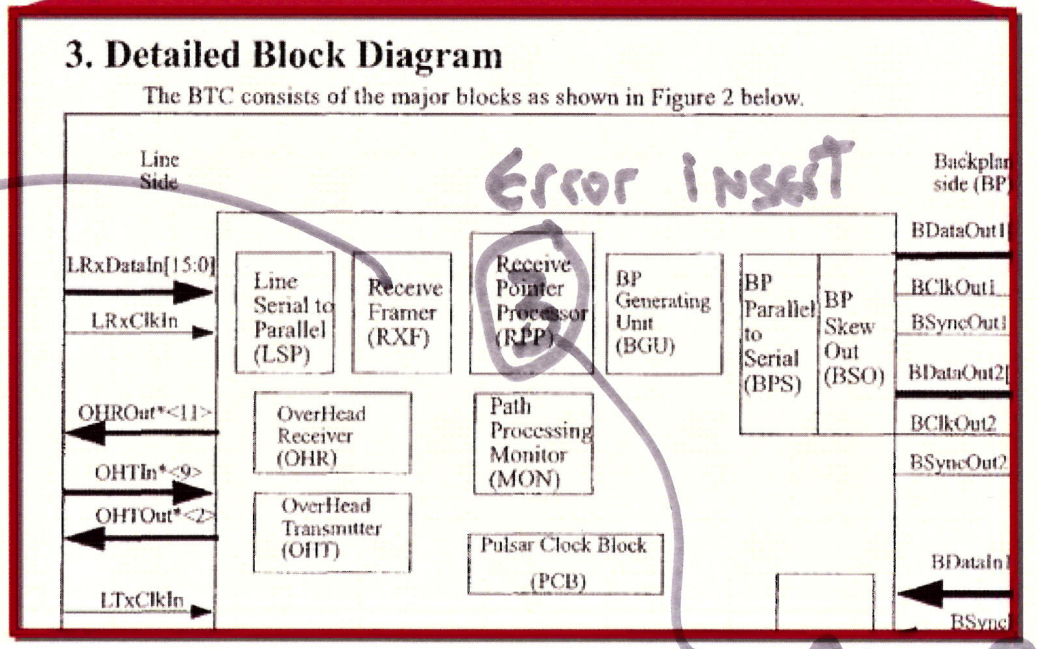


EXHIBIT 4

1 of 1 DOCUMENT

Analysis
As of: May 31, 2007

LEAPFROG ENTERPRISES, INC., Plaintiff-Appellant, v. FISHER-PRICE, INC. and MATTEL, INC., Defendants-Appellees.

06-1402

UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

2007 U.S. App. LEXIS 10912

May 9, 2007, Decided

PRIOR HISTORY: [*1] Appealed from: United States District Court for the District of Delaware. Judge Gregory M. Sleet. *Leapfrog Enters. v. Fisher-Price, Inc., 2006 U.S. Dist. LEXIS 13907 (D. Del., Mar. 30, 2006)*

DISPOSITION: AFFIRMED.

CASE SUMMARY:

PROCEDURAL POSTURE: Appellant, the holder of a patent, brought an action against appellee competitors, alleging that the competitors infringed the patent which related to a learning device to help young children read phonetically. The holder appealed the judgment of noninfringement and patent invalidity entered in the United States District Court for the District of Delaware.

OVERVIEW: The holder contended that the competitors' device infringed the patent because it satisfied the patent claim of allowing a child to choose a particular depicted letter and receiving a recorded response of the phoneme of the selected letter. The holder also argued that prior art taught a mechanical device which was different in structure and interrelation from the patent's electrical device. The appellate court held, however, that the findings of noninfringement and invalidity based on obviousness were proper. The competitors' device only allowed selection of a word rather than a depicted letter, the same response resulted no matter which letter in the word the child touched, and a response corresponding to a word was not the same as a response corresponding to a letter. Further, prior art and the holder's patent both taught a device for teaching reading based on the association of letters with their phonemic sounds, and the patent merely updated the prior art device with modern electronics that were common by the time of the alleged invention.

OUTCOME: The judgment of noninfringement and patent invalidity was affirmed.

LexisNexis(R) Headnotes

Patent Law > Infringement Actions > General Overview
Patent Law > Jurisdiction & Review > Standards of Review > Clearly Erroneous Review
[HN1] A district court's determination of patent infringement is a question of fact that an appellate court reviews for clear error. Under the clear error standard, the district court's findings is not overturned in the absence of a definite and firm conviction that a mistake has been made.

Patent Law > Jurisdiction & Review > Standards of Review > Clearly Erroneous Review

Patent Law > Jurisdiction & Review > Standards of Review > De Novo Review
Patent Law > Nonobviousness > Evidence & Procedure > Fact & Law Issues
[HN2] Obviousness of a patent claim is a question of law, reviewed de novo, based upon underlying factual questions which are reviewed for clear error following a bench trial.

Patent Law > Nonobviousness > Evidence & Procedure > General Overview
[HN3] An obviousness determination is not the result of a rigid formula disassociated from the consideration of the facts of a case. Indeed, the common sense of those skilled in the art demonstrates why some combinations would have been obvious where others would not.

COUNSEL: Ron E. Shulman, Wilson Sonsini Goodrich & Rosati, of Palo Alto, California, argued for plaintiff-appellant. With him on the brief were Terry Kearney and Michael A. Berta.

James Galbraith, Kenyon & Kenyon LLP, of New York, New York, argued for defendants-appellees. With him on the brief were Richard L. DeLucia and John Flock; and John R. Hutchins, of Washington, DC. Of counsel was Jeffrey M. Butler, of New York, New York.

JUDGES: Before MAYER, LOURIE, and DYK, Circuit Judges.

OPINION BY: LOURIE

OPINION: LOURIE, Circuit Judge.

Leapfrog Enterprises, Inc. ("Leapfrog") appeals from the order of the United States District Court for the District of Delaware entering judgment of noninfringement and invalidity of claim 25 of Leapfrog's *U.S. Patent 5,813,861 ("the '861 patent")* in favor of Fisher-Price, Inc. and Mattel, Inc. (collectively "Fisher-Price"). We affirm.

BACKGROUND

Leapfrog filed suit in October 2003, alleging that Fisher-Price's PowerTouch product infringed claim 25 of the *'861 patent*. Leapfrog amended the complaint to add Mattel, Inc. as a codefendant in September **[*2]** 2004. The *'861 patent* relates to a learning device to help young children read phonetically. Claim 25 reads as follows:

> An interactive learning device, comprising:
>
> a housing including a plurality of switches;
>
> a sound production device in communication with the switches and including a processor and a memory;
>
> at least one depiction of a sequence of letters, each letter being associable with a switch; and
>
> a reader configured to communicate the identity of the depiction to the processor,
>
> wherein selection of a depicted letter activates an associated switch to communicate with the processor, causing the sound production device to generate a signal corresponding to a sound associated with the selected letter, the sound being determined by a position of the letter in the sequence of letters.

'861 patent, col.10 ll.23-36.

In an April 7, 2005 Order, the trial court construed a number of terms from claim 25 of the patent. The court construed the phrase "selection of a depicted letter" to mean "choosing a particular depicted letter from the depicted sequence of letters by contacting or coming into proximity to that particular depicted letter." **[*3]** Leapfrog Enters., Inc. v. Fisher-Price, Inc., No. 03-927 (D. Del. Apr. 7, 2005).

The accused PowerTouch device consists of a hinged plastic housing containing electronics and a speaker that opens to lie flat. When so opened, a user places a book made for use with the device in a rectangular recess in the housing. The books contain large, colorful pictures that also show words associated with the objects shown in those pictures. The user may select one of multiple modes of operation. In phonics mode, when the user touches one of the words on the page, the device pronounces the word, then pronounces each phoneme of the word in

sequence, and finally pronounces the entire word again. The device relies on a grid of "crosspoints" located in the area underneath where the books are placed to detect the location on the page being touched by the user. The processor in the device may be programmed to associate a particular response with each crosspoint. Some of the words on the pages of the books are large enough that each letter of the word corresponds to a separate crosspoint. However, the phonics mode operates in the same manner for those words, with pronunciation of the word, the phonemes, **[*4]** and the word again, regardless which letter the user touches because each letter has been associated with the same response in the device's programming.

The case proceeded to trial, but the jury deadlocked on May 27, 2005. The parties stipulated that the case would be submitted to the trial court for decision, based on the record and the rulings made by the court at the time the case was submitted to the jury.

The trial court issued its decision on March 30, 2006, finding claim 25 of the *'861 patent* not infringed and invalid as obvious. The court found that the accused PowerTouch device could not practice the "selection of a depicted letter" because it only allowed selection of words rather than letters. The court thus found that the PowerTouch did not infringe claim 25. The court also concluded that claim 25 was invalid as obvious in view of the combination of *U.S. Patent 3,748,748* to Bevan, the Texas Instruments Super Speak & Read ("SSR") device, and the knowledge of one of ordinary skill in the art as represented by the testimony of Fisher-Price's technical expert, Ronald Milner.

Leapfrog timely appealed. We have jurisdiction pursuant to **[*5]** *28 U.S.C. § 1295(a)(1)*.

DISCUSSION

A. Noninfringement

[HN1] The district court's determination of infringement is a question of fact that we review for clear error. *Abraxis Bioscience, Inc. v. Mayne Pharma (USA) Inc., 467 F.3d 1370, 1375 (Fed. Cir. 2006)*. "Under the clear error standard, the court's findings will not be overturned in the absence of a definite and firm conviction that a mistake has been made." *Impax Labs., Inc. v. Aventis Pharms., Inc., 468 F.3d 1366, 1375 (Fed. Cir. 2006)* (quotation omitted).

On appeal, Leapfrog does not challenge the district court's construction of the phrase "selection of a depicted letter," but argues that the court clearly erred in applying that construction to the facts of the case. More specifically, Leapfrog argues that the PowerTouch does allow "choosing a particular depicted letter" because in at least some cases each letter of a word corresponds to a separate crosspoint. Thus, the fact that the response of the device is the same, no matter which letter the user touches, is irrelevant because the user may still choose particular letters.

Fisher-Price also does not challenge the district court's claim construction, and **[*6]** Fisher-Price responds that the district court correctly determined that selection by choosing a particular letter is only meaningful if making one letter choice results in an outcome different from making a different letter choice. Fisher-Price argues that the district court correctly found that only the word can be selected if the choice of letter, within a particular word, is irrelevant to the response of the device.

We find no clear error in the district court's application of the claim to the essentially undisputed facts of this case. The court's conclusion that the Fisher-Price PowerTouch only allows selection of a word rather than "a depicted letter" comports with its construction of "selection" to mean "choosing." The ordinary meaning of choice requires that the alternatives from which the choice is made will result in different possible outcomes. With the PowerTouch device, the same outcome results no matter which letter in the word the user touches. This understanding is also consistent with the way that selection of a depicted letter is described in the patent.

> Every time the child depresses a letter key, the book will recite the phoneme of the letter associated **[*7]** with that letter, in the context that the letter is used in the word or phrase depicted on the card, here "ball." Thus, for the example where the subject is "ball" as shown if the child depresses the correct letter key of "b" the processor will sound the phoneme "b" as "b" is pronounced in "ball."

'861 patent, col.6 ll.17-23. Most importantly, this understanding of selection is also most consistent with

the language of claim 25 itself. The PowerTouch device does not generate a signal corresponding to a sound associated with the selected letter, as the claim requires. A signal corresponding to a word is not the same as a signal corresponding to a letter. If the claim were meant to encompass a device that always enunciates all the letters of a word no matter which letter was selected, the claim language requiring that "the sound be[] determined by a position of the letter in the sequence of letters" would be superfluous because no such determination would be necessary.

Leapfrog comes well short of supporting a definite and firm conviction that a mistake has been made, and we therefore affirm the district court's entry of judgment of noninfringement in favor of Fisher-Price. **[*8]**

B. Obviousness

[HN2] "Obviousness is a question of law, reviewed de novo, based upon underlying factual questions which are reviewed for clear error following a bench trial." *Alza Corp. v. Mylan Labs., Inc., 464 F.3d 1286, 1289 (Fed. Cir. 2006)* (citing *Ruiz v. A.B. Chance Co., 357 F.3d 1270, 1275 (Fed. Cir. 2004))*.

Leapfrog argues that the district court engaged in improper hindsight in reaching its conclusion of obviousness by concluding that all of the limitations of the claim are found in the prior art. Leapfrog also argues that the court's finding that the Bevan device has the same functionality as claim 25 was clearly erroneous because the components of Bevan's device are mechanical, and thus different in structure and interrelation from the electronic components described in claim 25, and therefore cannot provide the same functionality. Leapfrog argues that there was inadequate evidence in the record to support a motivation to combine Bevan, the Texas Instruments SSR, and a reader to arrive at the invention of claim 25. Finally, Leapfrog argues that the district court did not properly consider the strong evidence of secondary considerations **[*9]** of nonobviousness.

In response, Fisher-Price argues that claim 25 is nothing more than the Bevan device, a toy that teaches reading based on the association of letters with their phonemic sounds, updated with modern electronics that were common by the time of the alleged invention. Fisher-Price also responds that particularized and specific motivations to combine need not be found in the prior art references themselves in the context of an improvement that arises from a desire to generally improve a known device (e.g., to make the product smaller, lighter, or less expensive) using newer technology. Finally, Fisher-Price argues that the district court did give proper consideration to secondary considerations of nonobviousness, but simply concluded that those considerations were not sufficient to overcome the determination of obviousness based on primary considerations.

We agree with Fisher-Price that the district court correctly concluded that the subject matter of claim 25 of the *'861 patent* would have been obvious in view of the combination of Bevan, the SSR, and the knowledge of one of ordinary skill in the art. [HN3] An obviousness determination is not the result of a rigid formula **[*10]** disassociated from the consideration of the facts of a case. Indeed, the common sense of those skilled in the art demonstrates why some combinations would have been obvious where others would not. See *KSR Int'l Co. v. Teleflex Inc., 550 U.S. , 2007 U.S. LEXIS 4745, 2007 WL 1237837, at *12 (2007)* ("The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results."). Thus, we bear in mind that the goal of the claim 25 device was to allow a child to press a switch associated with a single letter in a word and hear the sound of the letter as it is used in that word. In this way, the child would both associate the sound of the letter with the letter itself and be able to sound out the word one letter at a time to learn to read phonetically. Accommodating a prior art mechanical device that accomplishes that goal to modern electronics would have been reasonably obvious to one of ordinary skill in designing children's learning devices. Applying modern electronics to older mechanical devices has been commonplace in recent years.

The Bevan patent was one of the pieces of prior art relied upon by the district court, **[*11]** and it describes an electro-mechanical learning toy. In the preferred embodiment of the Bevan device, a housing contains a phonograph record as a voice storage means, a speaker for playing sounds from the voice storage means, and an actuated electric motor to turn the record. Uniquely shaped puzzle pieces fit into correspondingly shaped openings in the top of the housing. Depressing the puzzle pieces in the openings causes the motor to turn the record and brings phonographic needles into contact with the portions of the record where the sounds associated with

the puzzle pieces are stored so that they can be played through the speaker. In one embodiment, each puzzle piece is imprinted with one letter from a word, and pressing each puzzle piece produces the sound of a single letter in that word. Thus, although it relies on an electric motor and mechanical structures rather than a processor and related electronics, Bevan teaches an apparatus that achieves the goals described above of associating letters with their sounds and encouraging children to sound out words phonetically through a similar type of interaction. We therefore see no clear error in the district court's finding that the **[*12]** Bevan device has the same method of operation, viewed as a whole, as claim 25 of Leapfrog's *'861 patent*.

A second piece of prior art relied upon by the district court was the Texas Instruments SSR. The SSR is a more modern type of prior art learning toy, constructed with electronic components, that has a slightly different mode of operation than Bevan. The SSR has a hinged plastic housing that opens to lie flat. Books for use with the toy fit into a recess in the housing. The housing contains switches that can detect when a child presses on different areas of the books' pages. The housing also contains a processor, memory, and a speaker to produce sounds. In one mode of operation, the SSR allows the child to press the first letter of a word and hear the sound of that letter. The remainder of the letters in the word are grouped together and played together. For example, the child can press the letter "t" and hear the t phoneme and then press "ug" to hear all the sounds in the word "tug." Similarly, the child can press the letter "b" and then "ug" to hear the sounds in "bug." The SSR does not include a reader that allows the processor to automatically identify the inserted book. Instead, **[*13]** the user can press a triangle printed on the first page of the book, and the processor determines from the location of the triangle printed on the page which book is inserted. Similarly, the user can press a star on each page of the book, and the processor determines from the location of the star on the page which page of the book is being viewed. Thus, the SSR provides a roadmap for one of ordinary skill in the art desiring to produce an electronics-based learning toy for children that allows the use of phonetic-based learning methods, including the association of individual letters with their phonemes.

We agree with the district court that one of ordinary skill in the art of children's learning toys would have found it obvious to combine the Bevan device with the SSR to update it using modern electronic components in order to gain the commonly understood benefits of such adaptation, such as decreased size, increased reliability, simplified operation, and reduced cost. While the SSR only permits generation of a sound corresponding to the first letter of a word, it does so using electronic means. The combination is thus the adaptation of an old idea or invention (Bevan) using newer **[*14]** technology that is commonly available and understood in the art (the SSR). We therefore also find no clear error in the finding of the district court that one of ordinary skill in the art could have utilized the electronics of the SSR device, with the method of operation taught by Bevan, to allow a child to press each individual letter in a word and hear the individual phonemes associated with each letter to sound out the words.

This combination of Bevan and the SSR lacks only the "reader" of claim 25 of the *'861 patent*. The district court found that readers were well-known in the art at the time of the invention. As there is ample evidence in the record to support that finding, we find no clear error in the court's determination. Furthermore, the reasons for adding a reader to the Bevan/SSR combination are the same as those for using readers in other children's toys--namely, providing an added benefit and simplified use of the toy for the child in order to increase its marketability. Leapfrog presents no evidence that the inclusion of a reader in this type of device was uniquely challenging or difficult for one of ordinary skill in the art. See *KSR, 2007 U.S. LEXIS 4745, 2007 WL 1237837, at *15* **[*15]** . Nor does Leapfrog present any evidence that the inclusion of a device commonly used in the field of electronics (a reader), and even in the narrower art of electronic children's toys, represented an unobvious step over the prior art. Our conclusion is further reinforced by testimony from the sole inventor at trial that he did not have a technical background, could not have actually built the prototype himself, and relied on the assistance of an electrical engineer and Sandia National Laboratory to build a prototype of his invention.

Finally, we do not agree with Leapfrog that the court failed to give proper consideration to secondary considerations. The district court explicitly stated in its opinion that Leapfrog had provided substantial evidence of commercial success, praise, and long-felt need, but that, given the strength of the prima facie obviousness showing, the evidence on secondary considerations was inadequate to overcome a final conclusion that claim 25

would have been obvious. We have no basis to disagree with the district court's conclusion.

In light of our review of the evidence and the lack of any clear error in the district court's factual findings, we agree **[*16]** with the district court's conclusion that claim 25 of the *'861* is invalid as obvious in view of the combination of Bevan, the SSR device, and the knowledge of one of ordinary skill in the art concerning readers.

CONCLUSION

For the reasons stated, we affirm the district court's grant of judgment that Fisher-Price's PowerTouch device does not infringe claim 25 of the *'861 patent* and that claim 25 of the *'861 patent* is invalid as obvious.

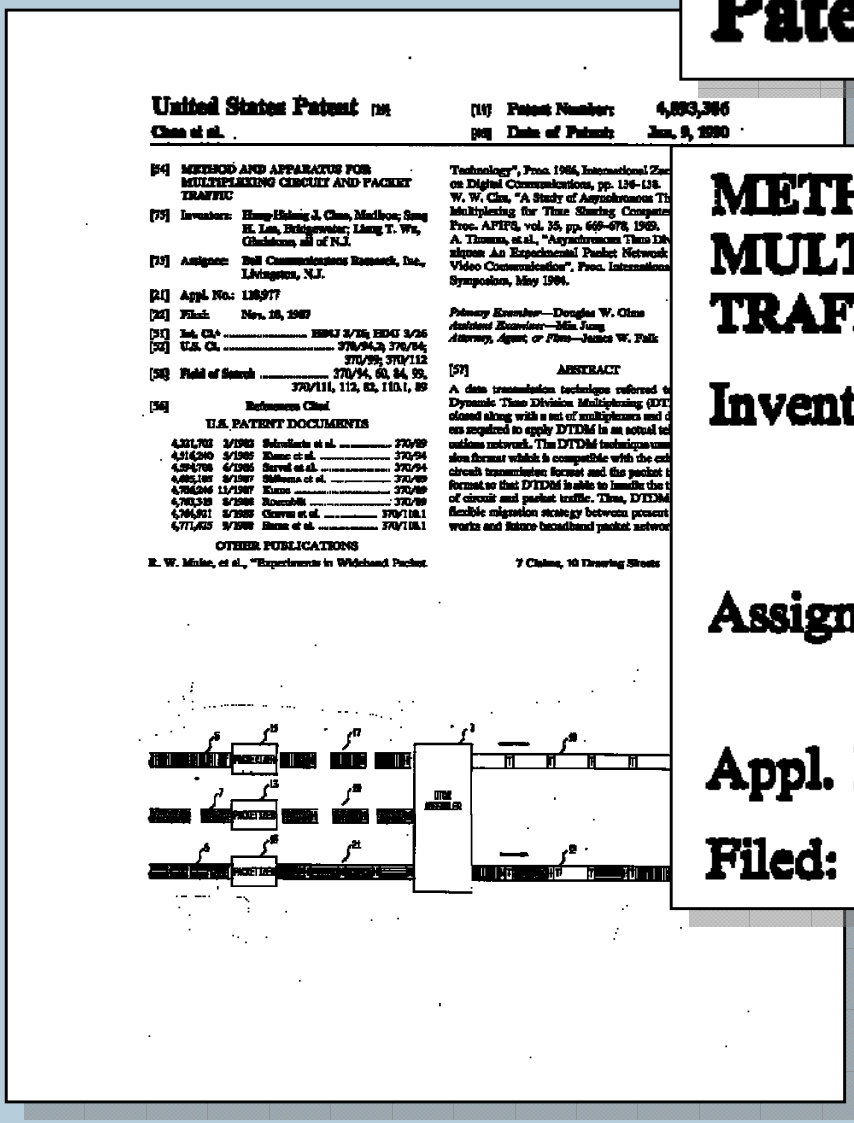
AFFIRMED

EXHIBIT 5

’306 Patent

The ’306 Patent

Patent Number: 4,893,306



United States Patent [19]
Chao et al.

[11] Patent Number: 4,893,306
[45] Date of Patent: Jan. 9, 1990

[54] METHOD AND APPARATUS FOR MULTIPLEXING CIRCUIT AND PACKET TRAFFIC

[75] Inventors: Hung-Hsiang J. Chao, Madison; Sang H. Lee, Bridgewater; Liang T. Wu, Gladstone, all of N.J.

[73] Assignee: Bell Communications Research, Inc., Livingston, N.J.

[21] Appl. No.: 118,977

[22] Filed: Nov. 10, 1987

[51] Int. Cl.[4] H04J 3/16; H04J 3/26
[52] U.S. Cl. 370/94.3; 370/94; 370/99; 370/112
[58] Field of Search 370/94, 60, 84, 99, 370/111, 112, 82, 110.1, 89

[56] References Cited

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4,514,840	4/1985	Kunz et al.	370/94
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4,685,102	8/1987	Shibuya et al.	370/89
4,704,246	11/1987	Kunz	370/89
4,703,321	8/1988	Rosenbluth	370/89
4,766,501	8/1988	Graves et al.	370/110.1
4,771,425	9/1988	Baran et al.	370/110.1

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A. Thomas, et al., "Asynchronous Time Di... nique: An Experimental Packet Network ... Video Communication", Proc. International ... Symposium, May 1984.

Primary Examiner—Douglas W. Olms
Assistant Examiner—Min Jung
Attorney, Agent, or Firm—James W. Falk

[57] ABSTRACT

A data transmission technique referred to ... Dynamic Time Division Multiplexing (DT... closed ring with a set of multiplexers and ... are required to apply DTDM in an actual te... nations network. The DTDM technique uses ... slot format which is compatible with the exi... circuit transmission format and the packet ... format so that DTDM is able to handle the t... of circuit and packet traffic. Thus, DTDM ... flexible migration strategy between present ... works and future broadband packet networ...

7 Claims, 10 Drawing Sheets

METHOD AND APPARATUS FOR MULTIPLEXING CIRCUIT AND PACKET TRAFFIC

Inventors: Hung-Hsiang J. Chao, Madison; Sang H. Lee, Bridgewater; Liang T. Wu, Gladstone, all of N.J.

Assignee: Bell Communications Research, Inc., Livingston, N.J.

Appl. No.: 118,977

Filed: Nov. 10, 1987

DTX 2002

The ’306 Patent

FIG. 4

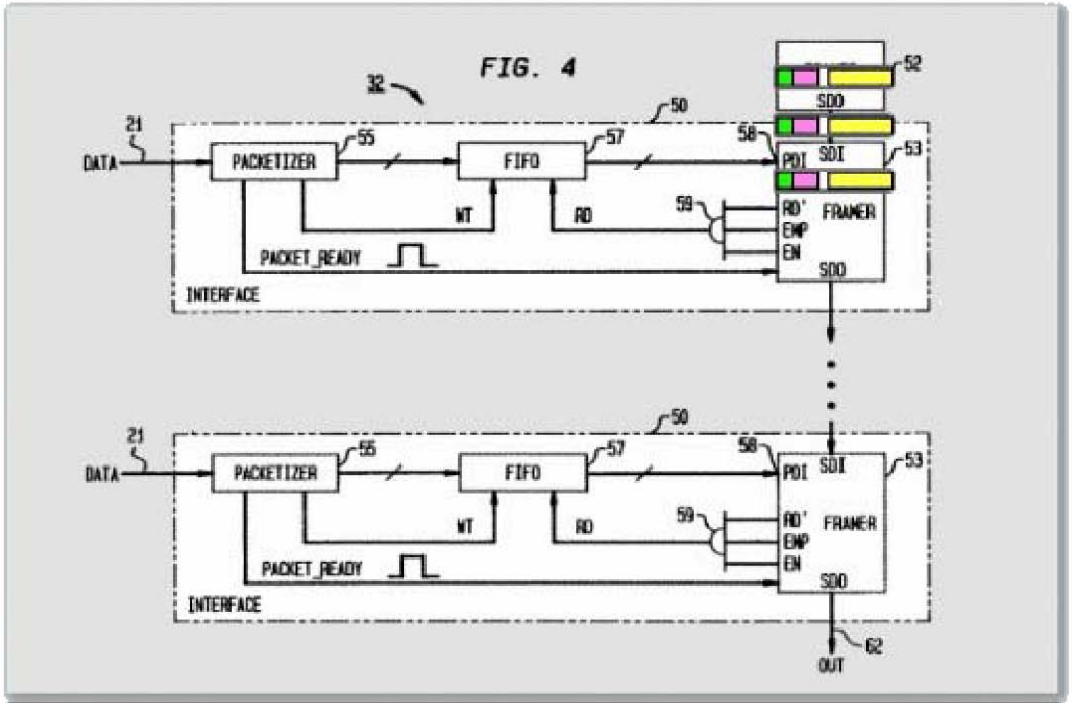
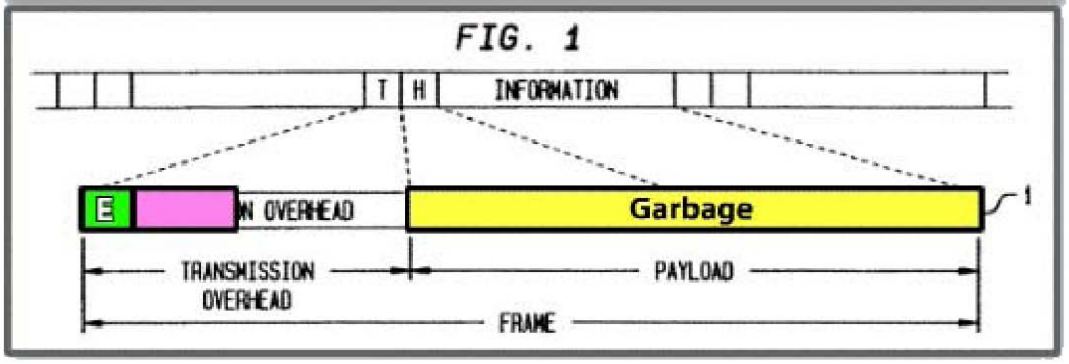
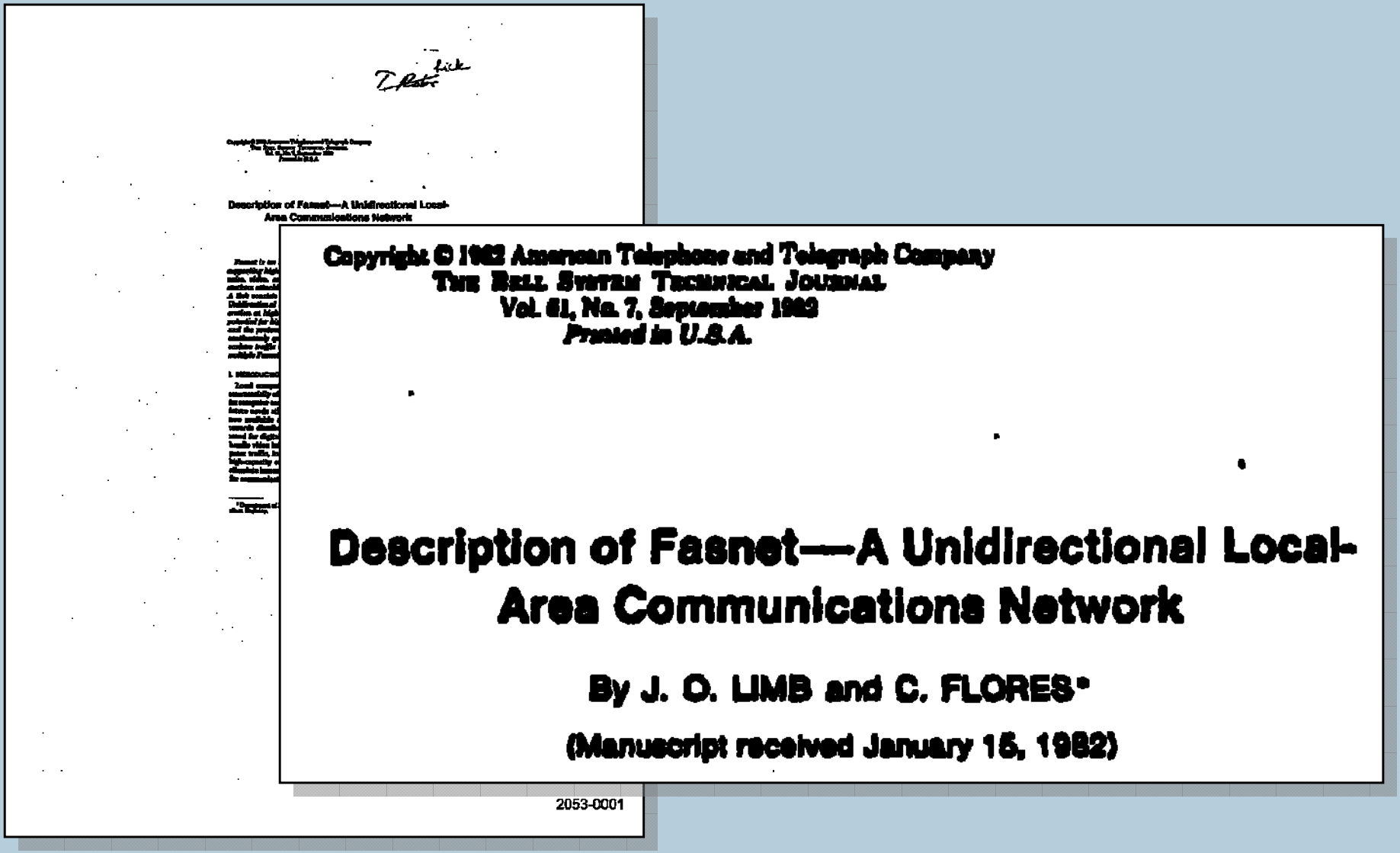


FIG. 1

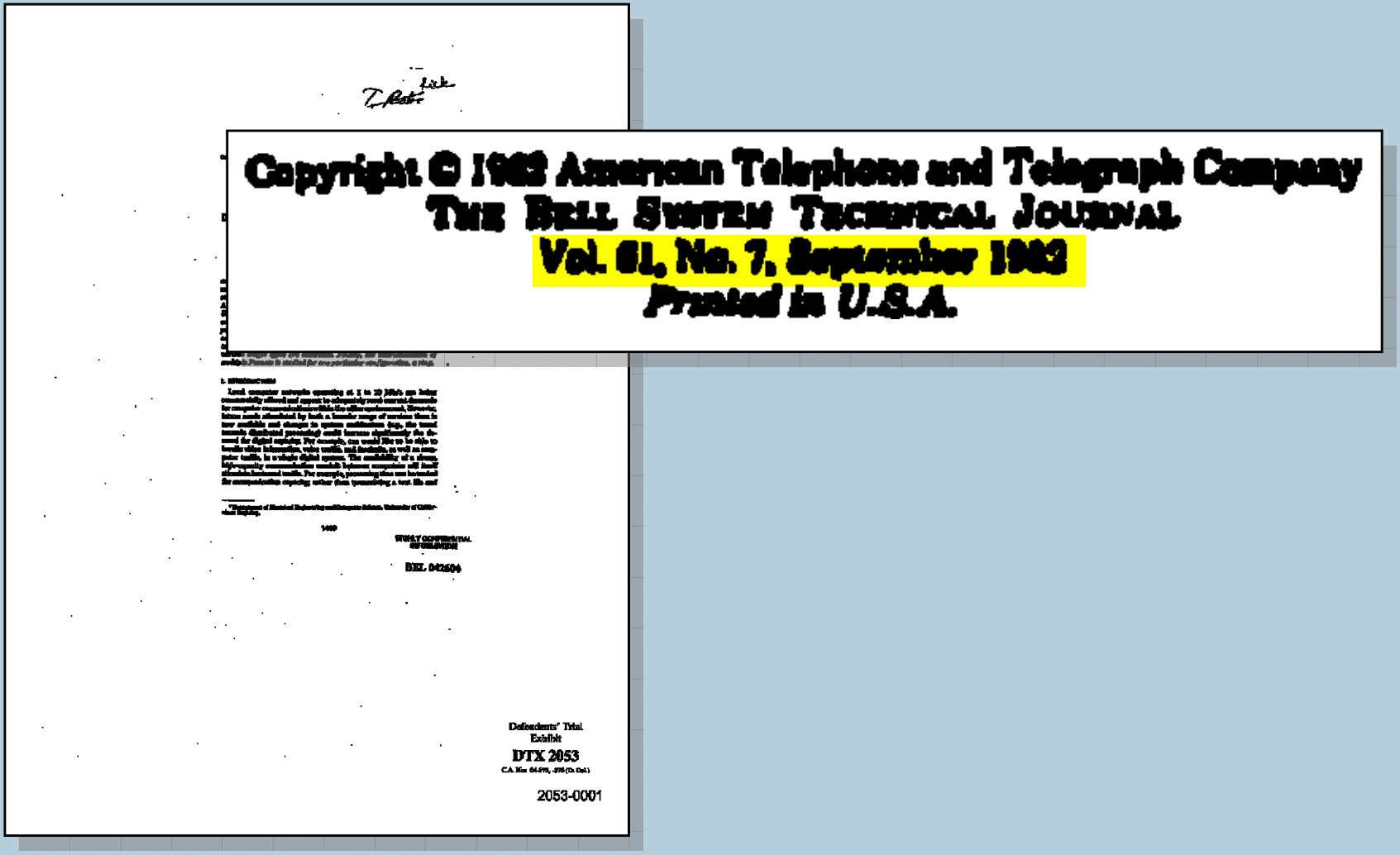


FasNet



DTX 2002

FasNet



DTX 2053

FasNet

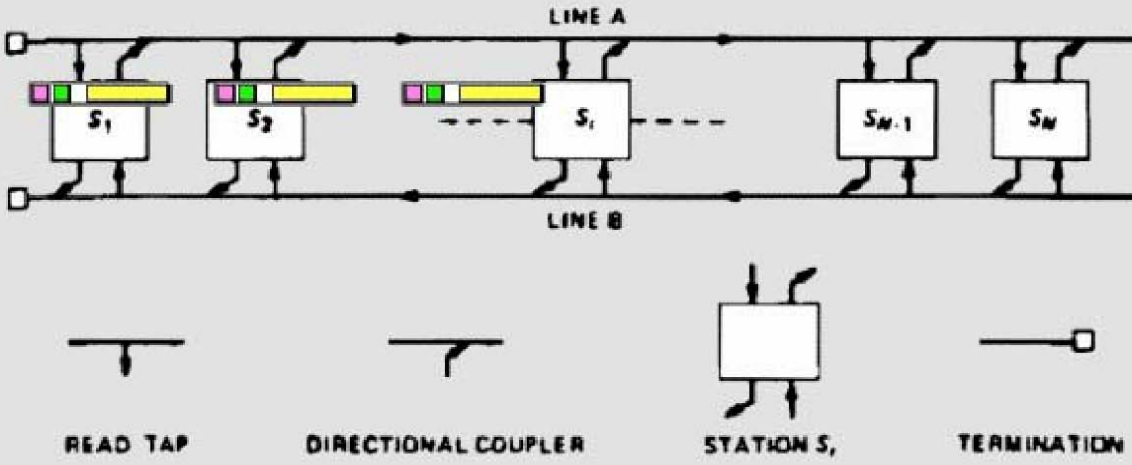


Fig. 2—Physical configuration of a Fasnet link.

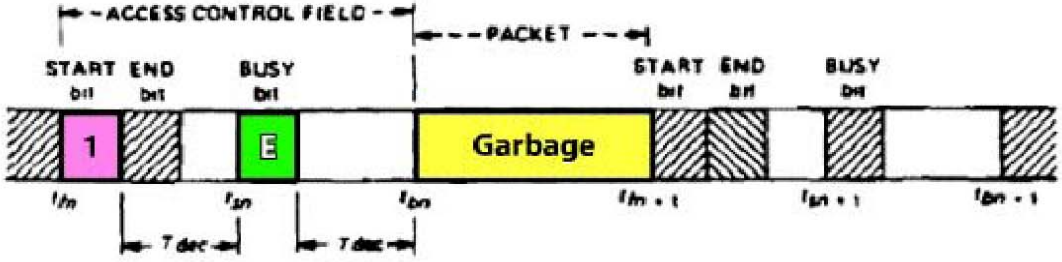
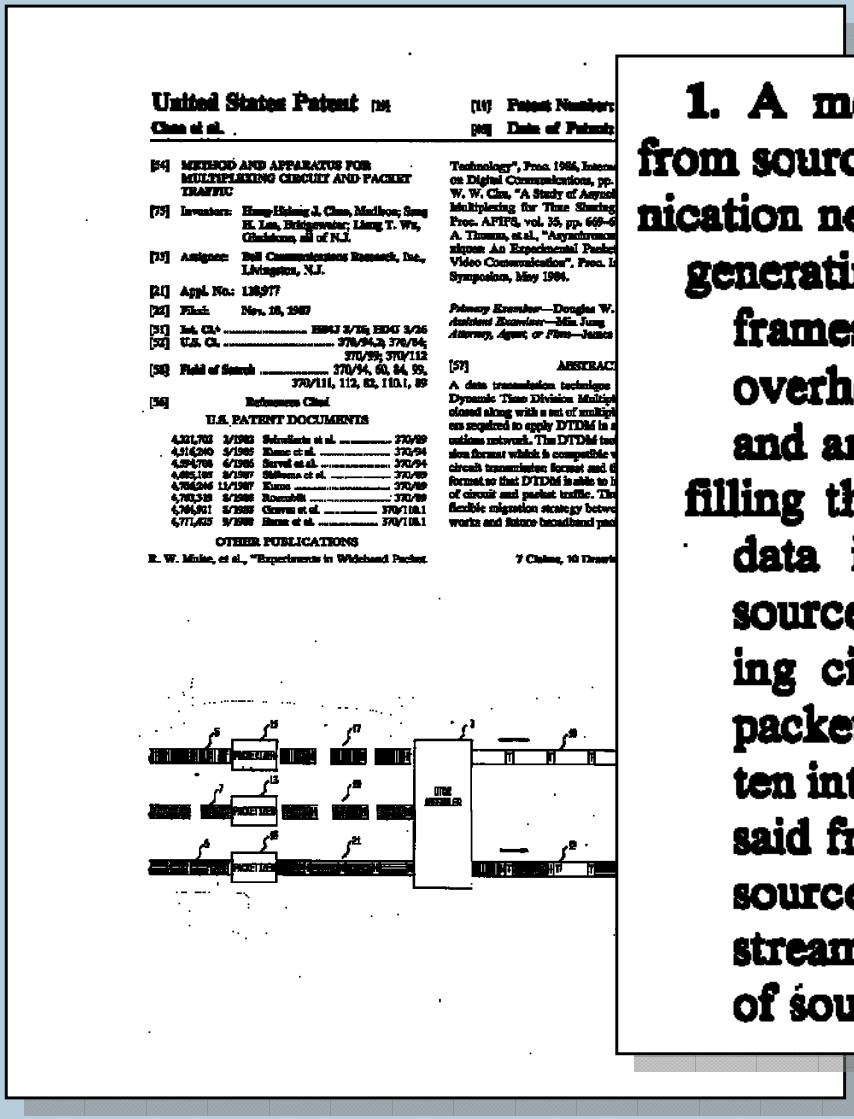


Fig. 3—The frame structure of Fasnet. Each frame consists of (*i*) an access control field containing START, END, and BUSY bits; and (*ii*) the packet as provided by the logical link sublayer.

Claim 1 Of The ’306 Patent



United States Patent [19]

Chen et al.

[54] METHOD AND APPARATUS FOR MULTIPLEXING CIRCUIT AND PACKET TRAFFIC

[75] Inventors: Hung-Hsiang J. Chen, Marlboro; Sung H. Lee, Bridgewater; Liang T. Wu, Gladstone, all of N.J.

[73] Assignee: Bell Communications Research, Inc., Livingston, N.J.

[21] Appl. No.: 128,977

[22] Filed: Nov. 18, 1987

[51] Int. Cl.[4] H04J 3/16; H04J 3/26

[52] U.S. Cl. 370/94.3; 370/94; 370/99; 370/112

[58] Field of Search 370/94, 60, 84, 99, 370/111, 112, 82, 110.1, 85

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4,594,708 6/1986 Servel et al. 370/94
4,685,102 8/1987 Shibuya et al. 370/89
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4,766,591 8/1988 Cowen et al. 370/110.1
4,771,425 9/1988 Baran et al. 370/110.1

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W. W. Chu, "A Study of Asynch... Multiplexing for Time Sharing... Proc. AFIPS, vol. 35, pp. 669-6...
A. Thomas, et al., "Asynchronous... niques: An Experimental Packe... Video Communication", Proc. I... Symposium, May 1984.

Primary Examiner—Douglas W. ...
Assistant Examiner—Min Jung ...
Attorney, Agent, or Firm—James ...

[57] ABSTRACT

A data transmission technique ... Dynamic Time Division Multip... closed ring with a set of multip... en required to apply DTDM in a ... nations network. The DTDM tec... slot format which is compatible ... circuit transmission format and ... format so that DTDM is able to ... of circuit and packet traffic. The ... flexible migration strategy betwe... works and future broadband pa...

7 Claims, 10 Drawi...

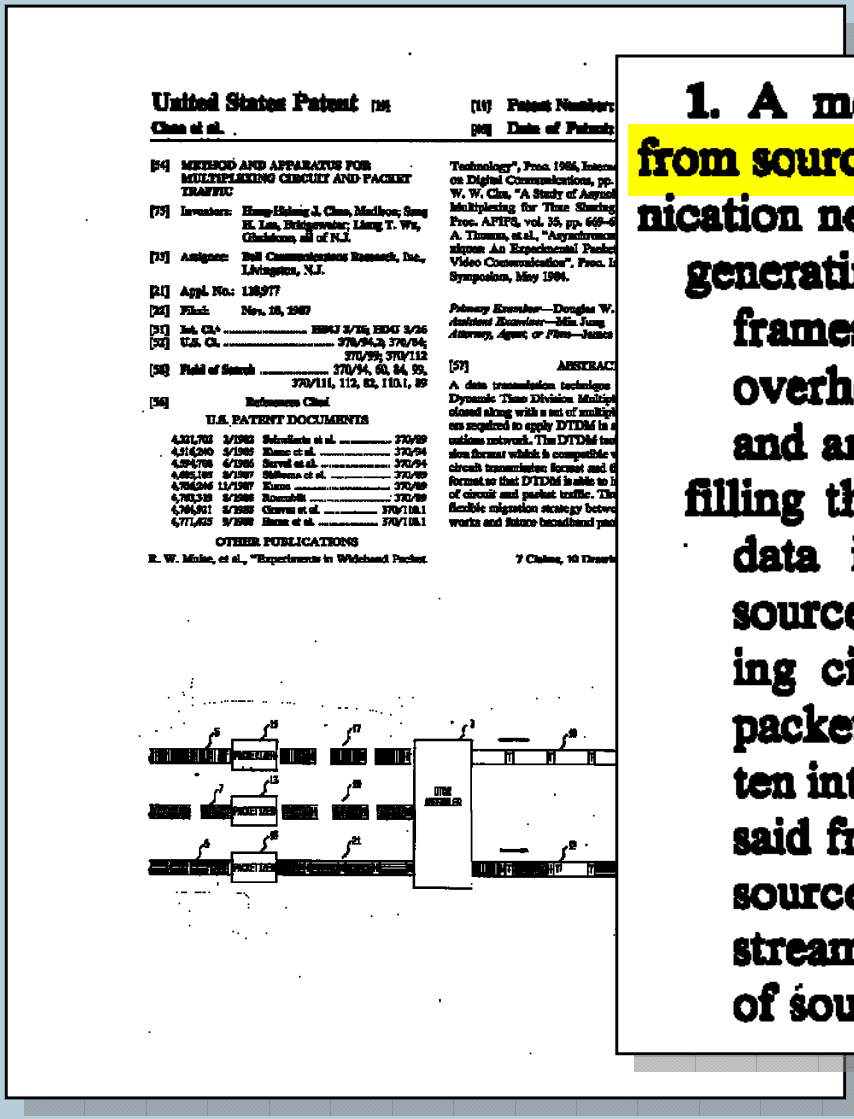
1. A method for simultaneously transmitting data from sources having different bit rates in a telecommunication network comprising the steps of:

generating a bit stream comprising a sequence of frames, each of said frames including a transmission overhead field containing frame timing information and an empty payload field, and

filling the empty payload fields in said frames with data in packetized format from a plurality of sources which have access to the bit stream including circuit or packet sources, such that data in packetized format from any of said sources is written into any available empty payload field of any of said frames for transmitting data from each of said sources at its own desired bit rate via said bit stream and for transmitting data from said plurality of sources simultaneously via said bit stream.

DTX 2002

Claim 1 Of The ’306 Patent



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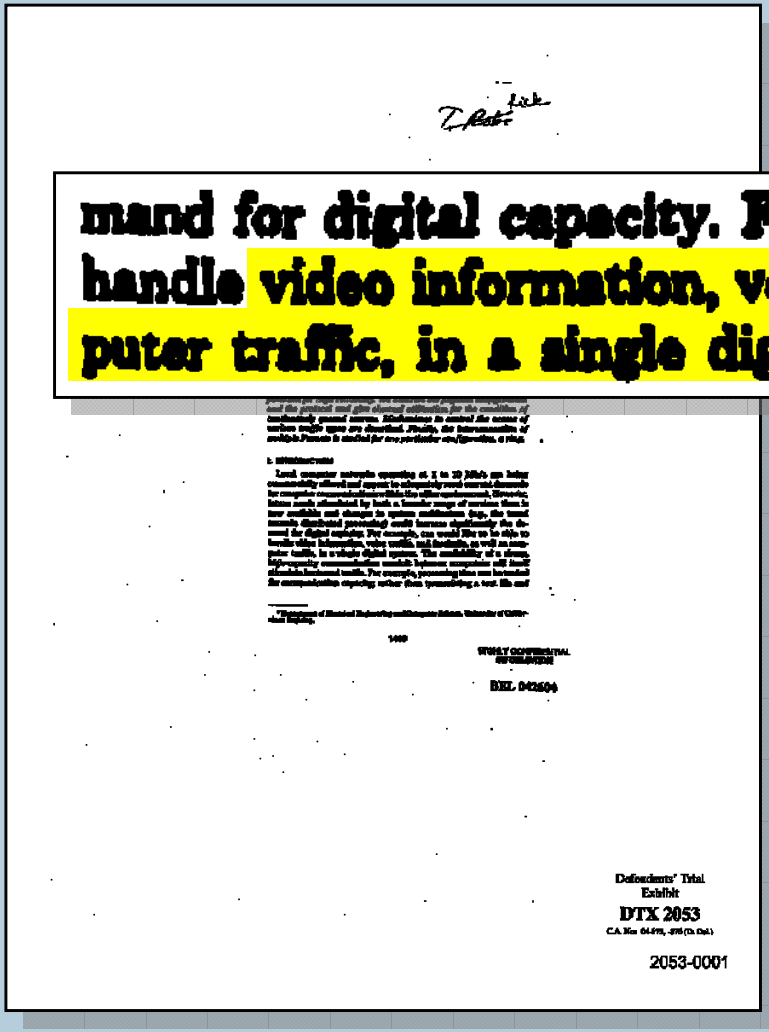
DTX 2002

FasNet

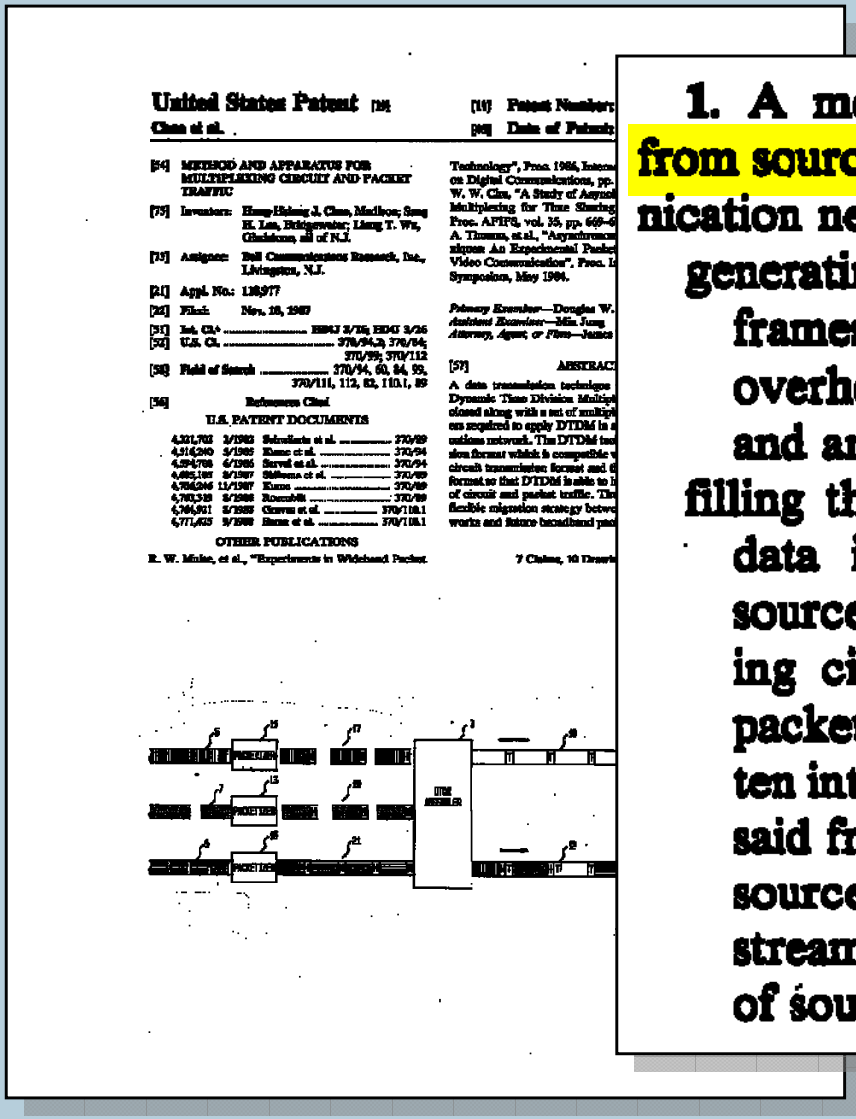


mand for digital capacity. For example, one would like to be able to handle video information, voice traffic, and facsimile, as well as computer traffic, in a single digital system. The availability of a cheap,

Defendants' Trial Exhibit
DTX 2053
2053-0001

DTX 2053

Claim 1 Of The ’306 Patent



United States Patent [19]

Chen et al.

[54] METHOD AND APPARATUS FOR MULTIPLEXING CIRCUIT AND PACKET TRAFFIC

[75] Inventors: Hung-Hsiang J. Chen, Marlboro; Sung H. Lee, Bridgewater; Liang T. Wu, Gladstone, all of N.J.

[73] Assignee: Bell Communications Research, Inc., Livingston, N.J.

[21] Appl. No.: 138,977

[22] Filed: Nov. 18, 1987

[51] Int. Cl.[4] H04J 3/16; H04J 3/26

[52] U.S. Cl. 370/94.3; 370/94; 370/99; 370/112

[58] Field of Search 370/94, 60, 84, 99, 370/111, 112, 82, 110.1, 85

[56] References Cited

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4,703,318 8/1988 Rocchetti 370/89
4,766,591 8/1988 Gitman et al. 370/110.1
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Primary Examiner—Douglas W. Olms
Assistant Examiner—Min Jung
Attorney, Agent, or Firm—James H. Laughlin, Jr.

[57] ABSTRACT

A data transmission technique for Dynamic Time Division Multiplexing with a set of multiplexers enclosed along with a set of multiplexers as required to apply DTDM in a unitary network. The DTDM technique allows format which is compatible with circuit transmission format and packet format so that DTDM is able to handle both of circuit and packet traffic. The flexible migration strategy between works and future broadband

7 Claims, 10 Drawing Sheets

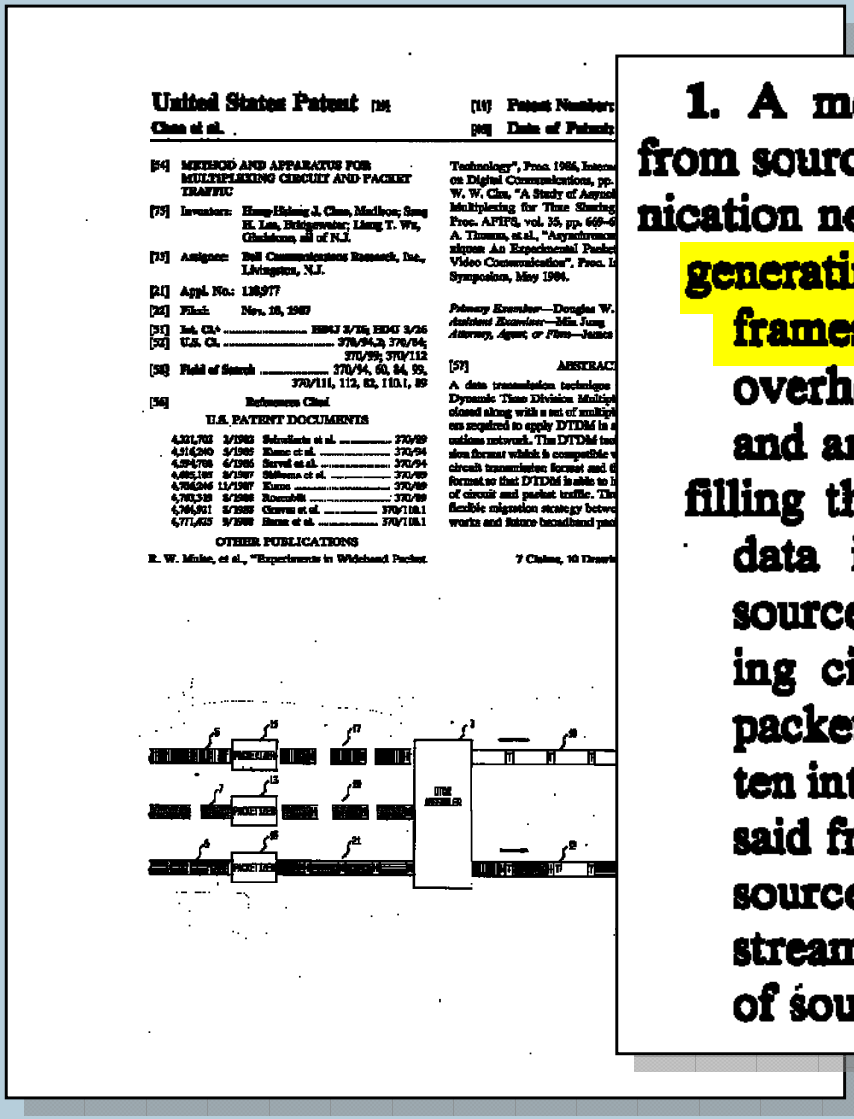
1. A method for simultaneously transmitting data from sources having different bit rates in a telecommunication network comprising the steps of:

generating a bit stream comprising a sequence of frames, each of said frames including a transmission overhead field containing frame timing information and an empty payload field, and

filling the empty payload fields in said frames with data in packetized format from a plurality of sources which have access to the bit stream including circuit or packet sources, such that data in packetized format from any of said sources is written into any available empty payload field of any of said frames for transmitting data from each of said sources at its own desired bit rate via said bit stream and for transmitting data from said plurality of sources simultaneously via said bit stream.

DTX 2002

Claim 1 Of The ’306 Patent



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A data transmission technique ... Dynamic Time Division Multiplexer ... closed ring with a set of multiplexers ... are required to apply DTDM ... nations network. The DTDM technique ... slow format which is compatible ... circuit transmission format and ... format so that DTDM is able to ... of circuit and packet traffic. The ... flexible migration strategy between ... works and future broadband ...

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DTX 2002

FasNet

Description of Fasnet—A Unidirectional Local-Area Communications Network

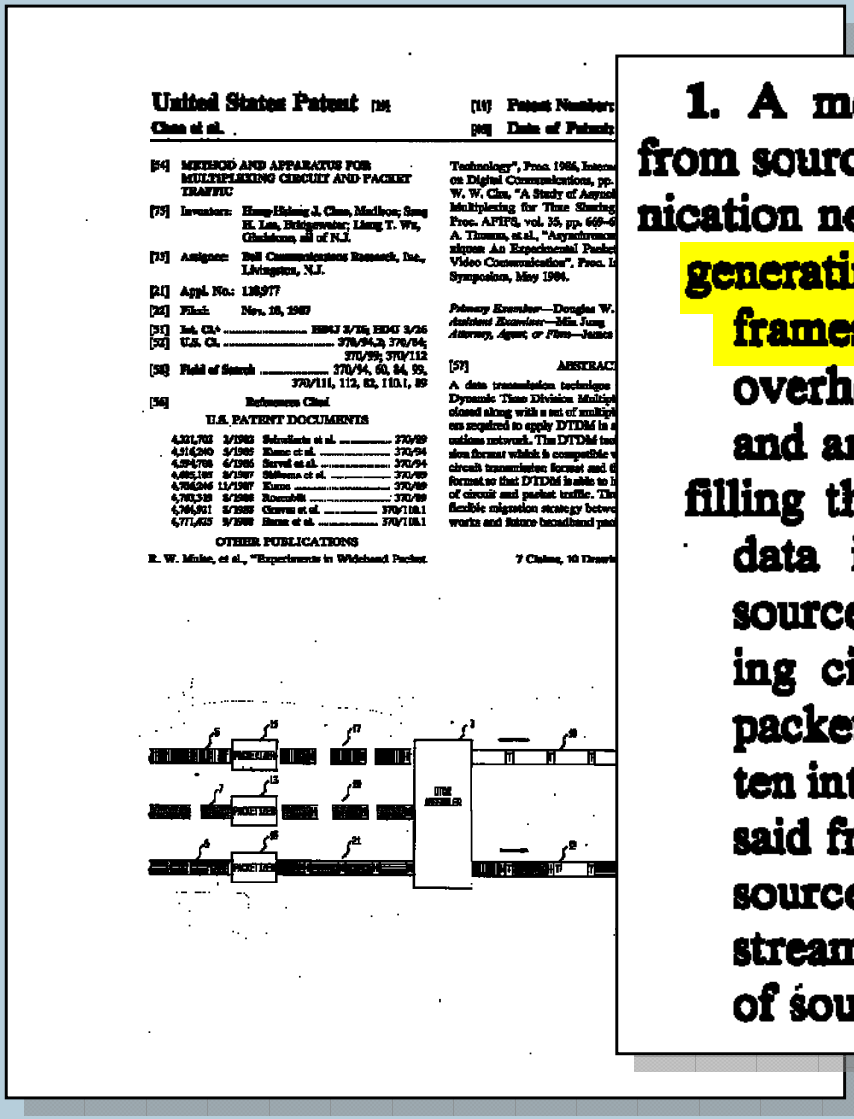
Exhibit
DTX 2053
C.A. Nos. 04-876, 876 [D. Del.]

2053-0001

3.2 Access control

Basic access control for Fasnet is as follows. The head station, S_1, initiates a cycle on line A. After a cycle has been initiated, each active station on the line with packets destined in the right direction is allowed to access the line for one slot. To do this, each station monitors the line. When it senses the line idle, it seizes the line for one slot. It has to wait for a new cycle to be initiated before it attempts to access the line again. The exact manner in which this is done efficiently and

Claim 1 Of The ’306 Patent



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DTX 2002

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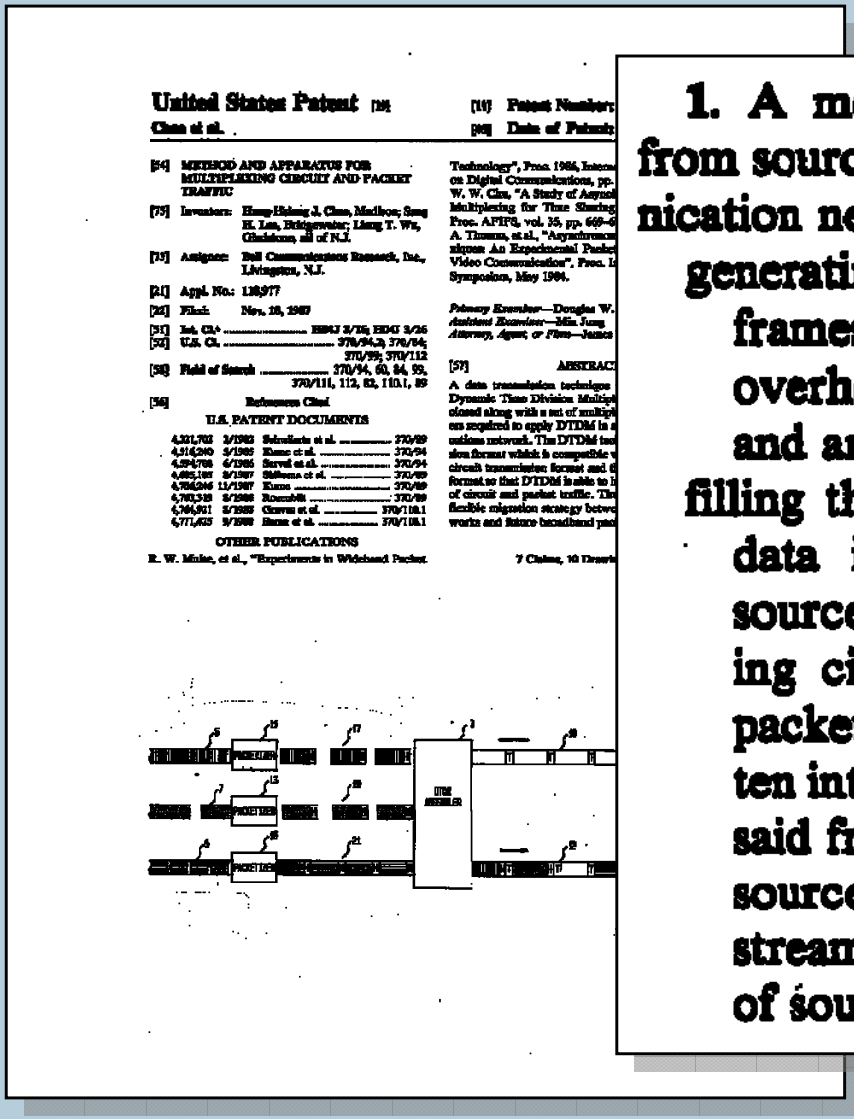

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4,685,102	8/1987	Shibano et al.	370/89
4,704,246	11/1987	Kano	370/89
4,703,318	8/1988	Rocchetti	370/89
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A data transmission technique for Dynamic Time Division Multiplexed ... closed ring with a set of multiplexers required to apply DTDM ... nations network. The DTDM technique ... slots format which is compatible ... circuit transmission format and ... format so that DTDM is able to ... of circuit and packet traffic. The ... flexible migration strategy between ... works and future broadband ...

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DTX 2002

The Court's Interpretation

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

TELCORDIA TECHNOLOGIES, INC., Plaintiff, v. ALCATEL USA, INC., Defendants. — Civil Action No. 04-874 GMS

TELCORDIA TECHNOLOGIES, INC., Plaintiff, v. — Civil Action No. 04-875 GMS

26. The terms "frame timing information" and "timing information" are construed as "frame alignment information."

ORDER CONSTRUING THE TERMS OF U.S. Patent Nos. 4,835,763, Re. 36,633, and 4,893,306

After considering the submissions of the parties and hearing oral argument on the matter, IT IS HEREBY ORDERED, ADJUDGED, and DECREED that, as used in the asserted claims of U.S. Patent No. 4,835,763 (the "'763 patent"), U.S. Patent No. Re. 36,633 (the "'633 patent"), and U.S. Patent No. 4,893,306 (the "'306 patent"),

A. The '763 Patent

Defendants' Trial Exhibit
DTX 2031
C.A. Nos. 04-875, -876 (D. Del.)
2031-0001

DTX 2031

FasNet

Description of Fasnet—A Unidirectional Local-Area Communications Network

Table I—Protocol and frame structures

	Protocol Structure	Frame Structure
Data link layer	Logical link control sublayer	DA/SA/LC/IU
	Media access control sublayer	FS/AC/DA/SA/LC/IU/FCS/FE
Physical layer	Physical layer signaling	FS/AC/DA/SA/LC/IU/FCS/FE

FS: Frame starting delimiter
AC: Access control field
DA: Destination address
SA: Source address
LC: Link control field
IU: Information unit from network layer
FCS: Frame check sequence
FE: Frame ending delimiter

Defendants' Trial Exhibit
DTX 2053
C.A. Nos. 04-875, -876 (D. Del.)

2053-0001

DTX 2053

FasNet

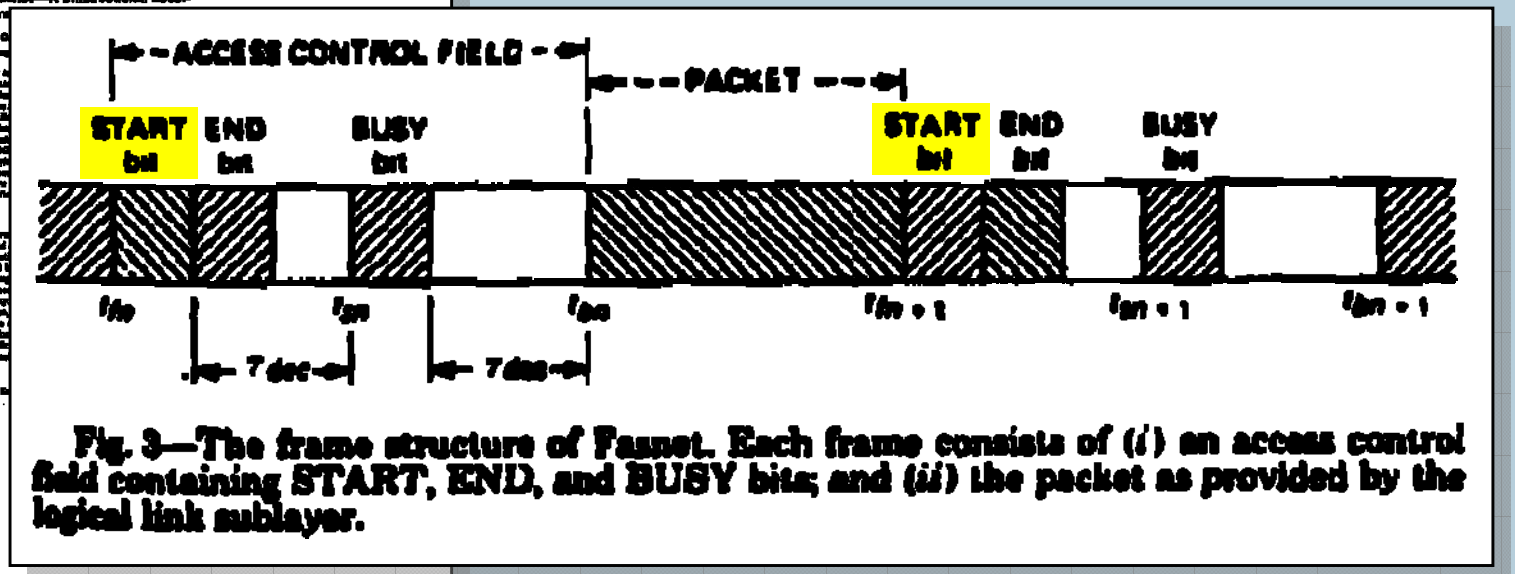
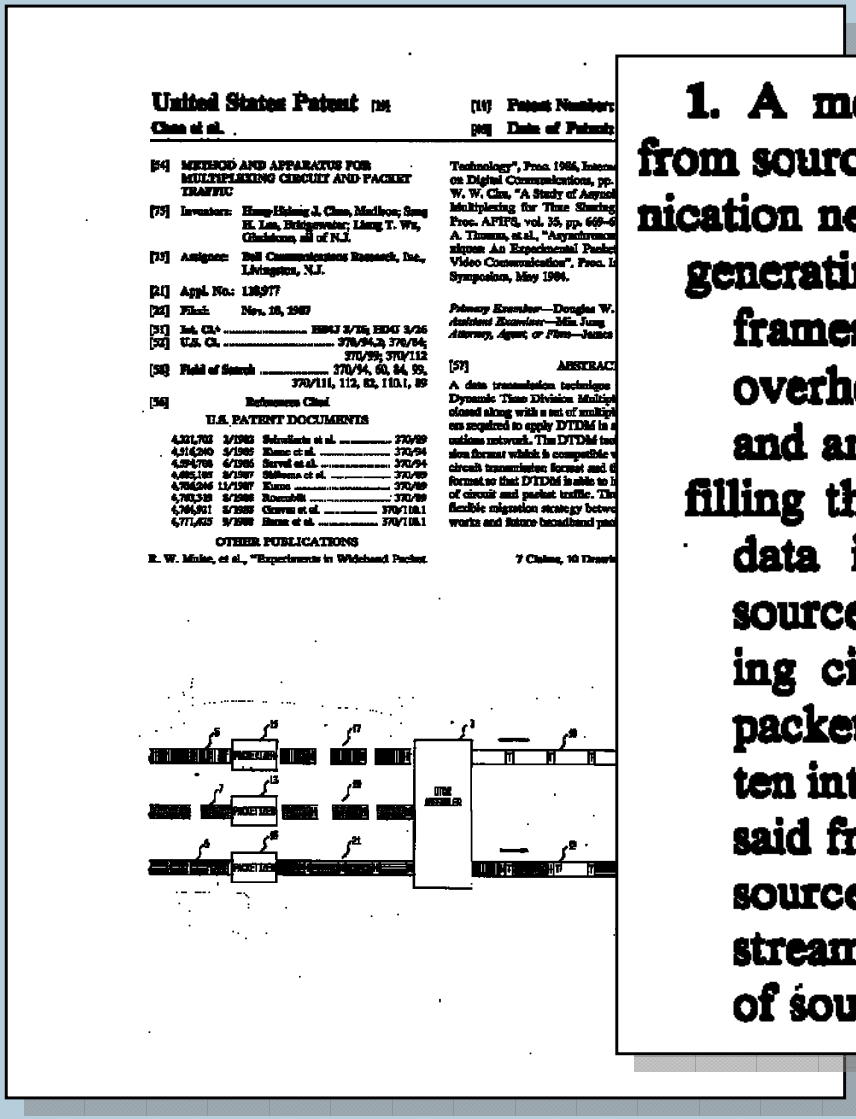


Fig. 3—The frame structure of Fasnet. Each frame consists of (*i*) an access control field containing START, END, and BUSY bits; and (*ii*) the packet as provided by the logical link sublayer.

Defendants' Trial Exhibit
DTX 2053
C.A. Nos. 04-876, -878 (D. Del.)
2053-0001

DTX 2053

Claim 1 Of The '306 Patent



1. A method for simultaneously transmitting data from sources having different bit rates in a telecommunication network comprising the steps of:

generating a bit stream comprising a sequence of frames, each of said frames including a transmission overhead field containing frame timing information and an empty payload field, and

filling the empty payload fields in said frames with data in packetized format from a plurality of sources which have access to the bit stream including circuit or packet sources, such that data in packetized format from any of said sources is written into any available empty payload field of any of said frames for transmitting data from each of said sources at its own desired bit rate via said bit stream and for transmitting data from said plurality of sources simultaneously via said bit stream.

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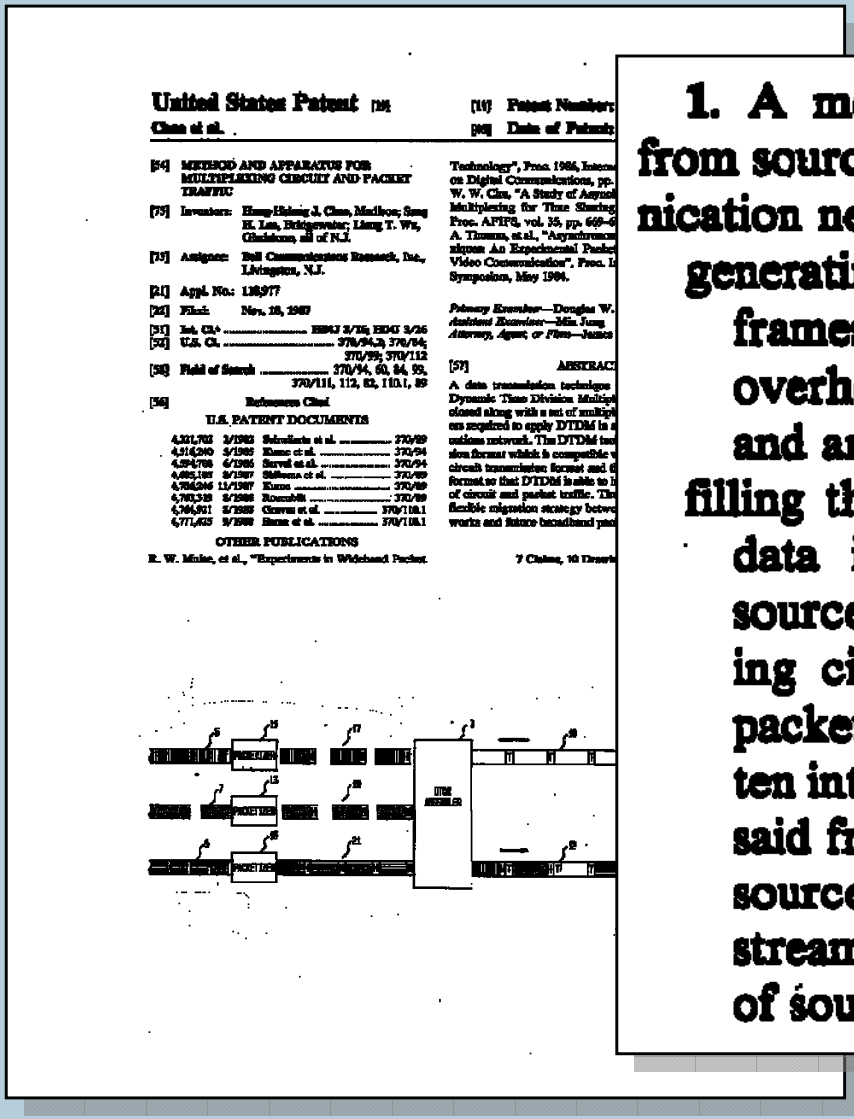
Claim 1 Of The ’306 Patent



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DTX 2002

The Court's Interpretation: "empty payload field"

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

TELCORDIA TECHNOLOGIES, INC., Plaintiff, v. ALCATEL USA, INC., Defendants. — Civil Action No. 04-874 GMS

TELCORDIA TECHNOLOGIES, INC., Plaintiff, v. — Civil Action No. 04-875 GMS

27. The term "empty payload field" is construed as "a payload field that is empty of source data, but including bit signals of some kind, i.e. garbage bits."

ORDER CONSTRUING THE TERMS OF U.S. Patent Nos. 4,835,763, Re. 36,633, and 4,893,306

After considering the submissions of the parties and hearing oral argument on the matter, IT IS HEREBY ORDERED, ADJUDGED, and DECREED that, as used in the asserted claims of U.S. Patent No. 4,835,763 (the "'763 patent"), U.S. Patent No. Re. 36,633 (the "'633 patent"), and U.S. Patent No. 4,893,306 (the "'306 patent"),

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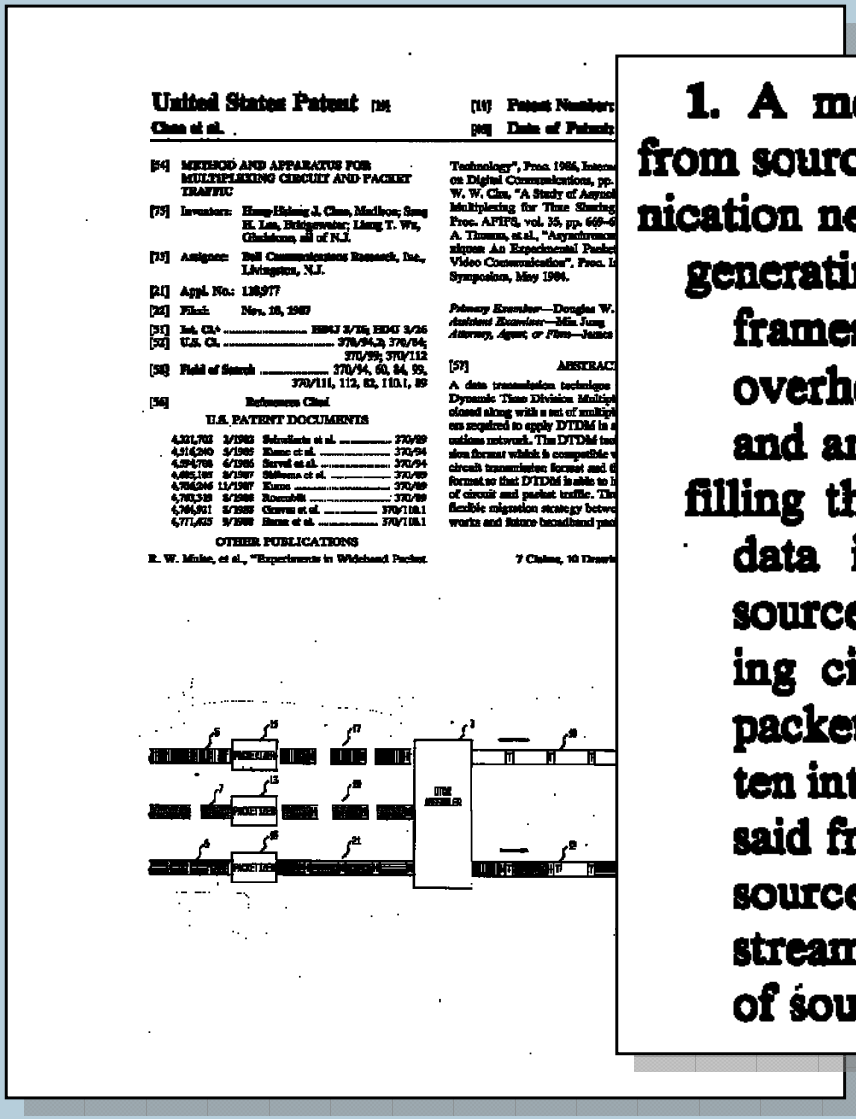
DTX 2031
C.A. Nos. 04-875, -876 (D. Del.)
2031-0001

DTX 2031

Claim 1 Of The ’306 Patent



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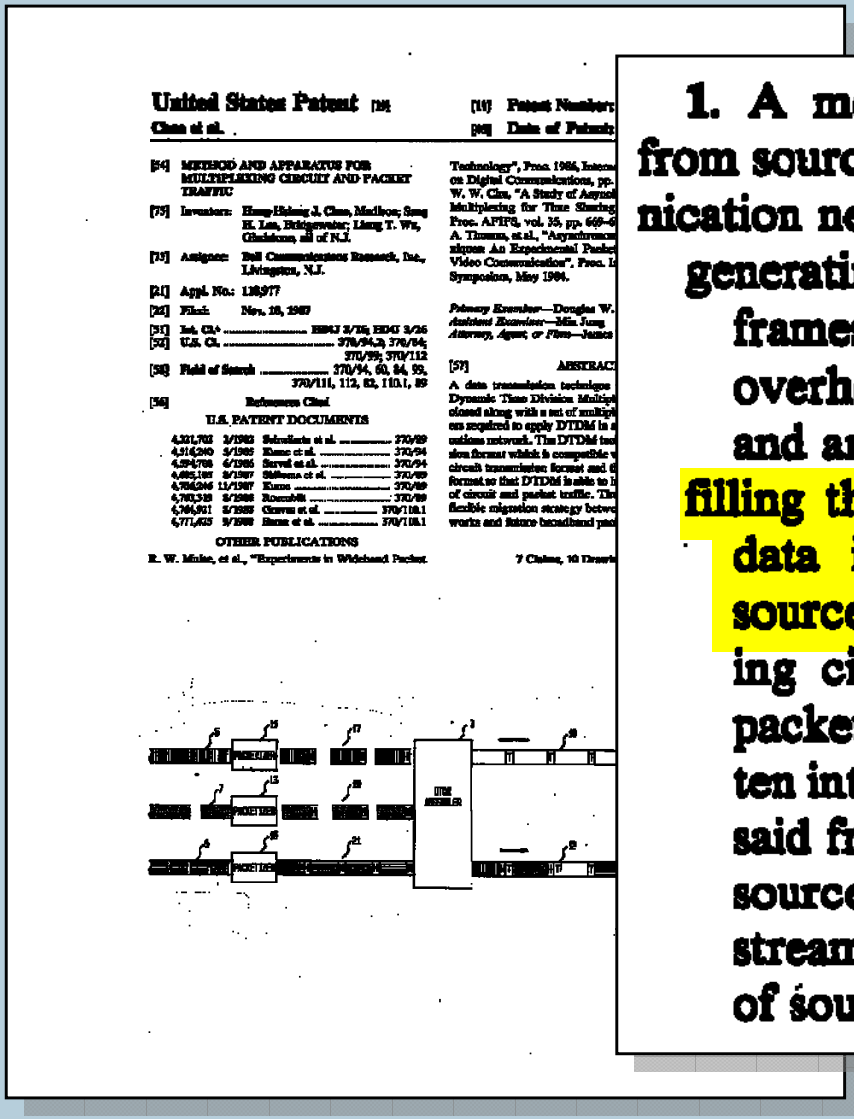

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Primary Examiner—Douglas W. Olms
Assistant Examiner—Min Jung
Attorney, Agent, or Firm—James W. Falk

[57] ABSTRACT

A data transmission technique for integrating Synchronous Time Division Multiplexing (STDM) and Dynamic Time Division Multiplexing (DTDM) such that a single communication channel with a set of multiplexing equipment is required to apply DTDM to a synchronous STDM system. The technique is particularly useful in a wideband integrated voice/data communication system, such as a broadband ISDN utilizing fast packet switching network. The DTDM technique provides a dynamic assignment of the STDM frame to form a DTDM frame which is compatible with the STDM frame format so that existing STDM equipment can be used directly for both STDM and DTDM traffic. A frame processor is provided at each node of the network to process the incoming frame from either an STDM or DTDM transmission system to extract the control information relating to the status of the frame and to update the control information for the next node. The frame processor is also used to multiplex both circuit and packet traffic. The technique provides a flexible migration strategy between STDM and DTDM networks and future broadband packet networks.

7 Claims, 10 Drawing Sheets

1. A method for simultaneously transmitting data from sources having different bit rates in a telecommunication network comprising the steps of:

generating a bit stream comprising a sequence of frames, each of said frames including a transmission overhead field containing frame timing information and an empty payload field, and

filling the empty payload fields in said frames with data in packetized format from a plurality of sources which have access to the bit stream including circuit or packet sources, such that data in packetized format from any of said sources is written into any available empty payload field of any of said frames for transmitting data from each of said sources at its own desired bit rate via said bit stream and for transmitting data from said plurality of sources simultaneously via said bit stream.

DTX 2002

FasNet

3.2 Access control

Basic access control for Fasnet is as follows. The head station, S_1, initiates a cycle on line A. After a cycle has been initiated, each active station on the line with packets destined in the right direction is allowed to access the line for one slot. To do this, each station monitors the line. When it senses the line idle, it seizes the line for one slot. It has to wait for a new cycle to be initiated before it attempts to access the line again. The exact manner in which this is done efficiently and

DTX 2053-007

FasNet

Considering the first method, any station S_i in the WAIT state that observes END = 1 may attempt to seize any empty slots on the opposite line.[12] The number of empty slots seized depends on the time the END = 1 frame takes to propagate to the next active station, which then seizes empty slots, thus preempting active stations downstream.* The intercycle gap now depends on the propagation time from the last active station to the end station and back. (The relative timing of the frame starts in the two lines will also affect the gap size). As shown in the example of Fig. 7, the intercycle gap has been reduced from nine slots to three, shown for line A only.

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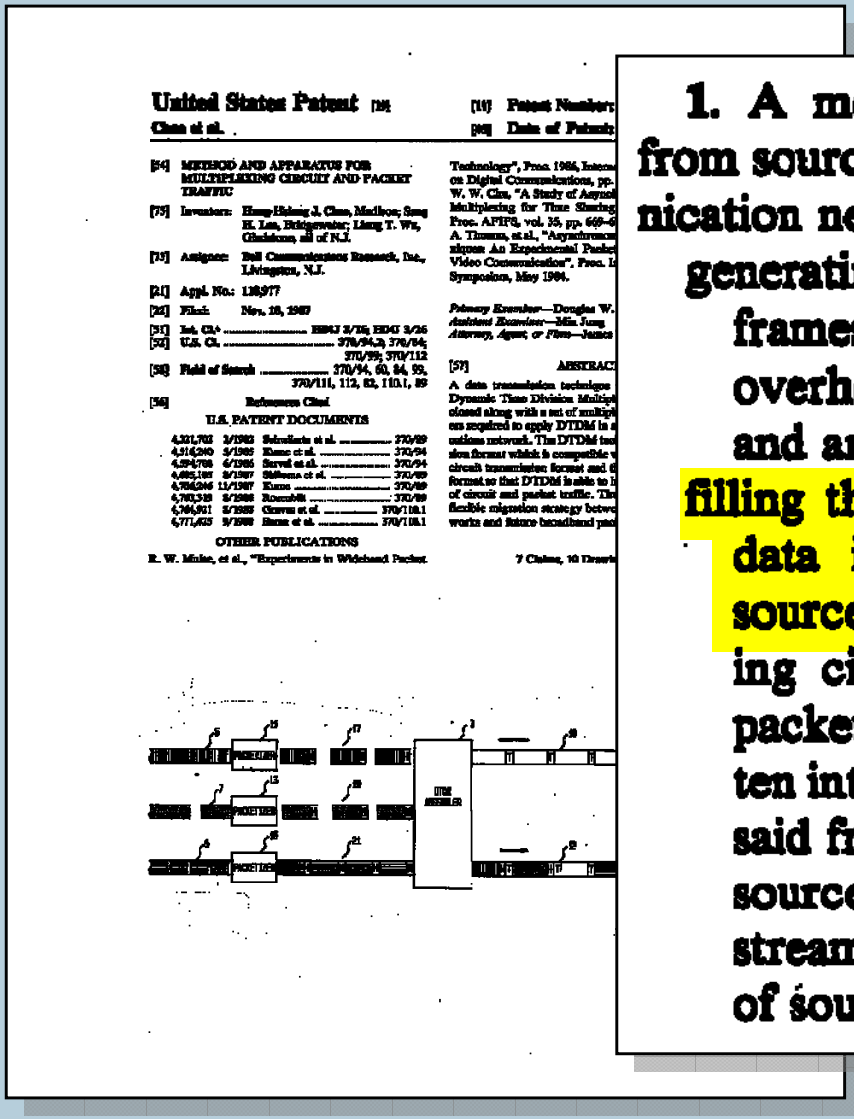
Claim 1 Of The ’306 Patent



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DTX 2002

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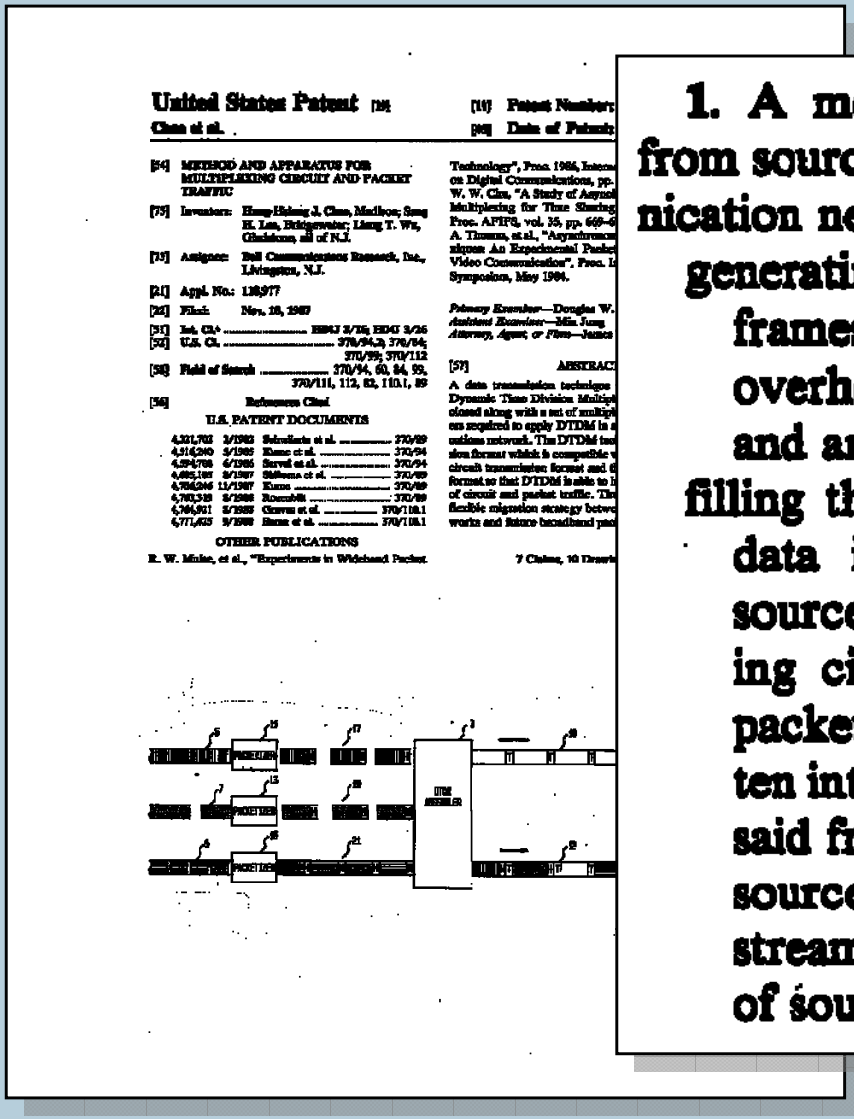

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Chen et al.

[54] METHOD AND APPARATUS FOR MULTIPLEXING CIRCUIT AND PACKET TRAFFIC

[75] Inventors: Hung-Hsiang J. Chen, Marlboro; Sung H. Lee, Bridgewater; Liang T. Wu, Gladstone, all of N.J.

[73] Assignee: Bell Communications Research, Inc., Livingston, N.J.

[21] Appl. No.: 128,977

[22] Filed: Nov. 18, 1987

[51] Int. Cl.[4] H04J 3/16; H04J 3/26

[52] U.S. Cl. 370/94.3; 370/94; 370/99; 370/112

[58] Field of Search 370/94, 60, 84, 99, 370/111, 112, 82, 110.1, 89

[56] References Cited

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R. W. Muise, et al., "Experiments in Wideband Packet Technology", Proc. 1988, International Zurich Seminar on Digital Communications, pp. ...

W. W. Chu, "A Study of Asynchronous Time Division Multiplexing for Time Sharing Computer Systems", Proc. AFIPS, vol. 35, pp. 669-...

A. Thomas, et al., "Asynchronous Time-Division Techniques: An Experimental Packet Network Integrating Video Communication", Proc. International Zurich Seminar, Symposium, May 1984.

Primary Examiner—Douglas W. ...
Assistant Examiner—Min Jung
Attorney, Agent, or Firm—James ...

[57] ABSTRACT

A data transmission technique ... Dynamic Time Division Multiplexing ... closed ring with a set of multiplexers ... are required to apply DTDM in a ... nations network. The DTDM technique ... slow format which is compatible ... circuit transmission format and ... format so that DTDM is able to ... of circuit and packet traffic. The ... flexible migration strategy between ... works and future broadband ...

7 Claims, 10 Drawing ...

1. A method for simultaneously transmitting data from sources having different bit rates in a telecommunication network comprising the steps of:

generating a bit stream comprising a sequence of frames, each of said frames including a transmission overhead field containing frame timing information and an empty payload field, and

filling the empty payload fields in said frames with data in packetized format from a plurality of sources which have access to the bit stream including circuit or packet sources, such that data in packetized format from any of said sources is written into any available empty payload field of any of said frames for transmitting data from each of said sources at its own desired bit rate via said bit stream and for transmitting data from said plurality of sources simultaneously via said bit stream.

DTX 2002

The Court's Interpretation: "available empty payload field"

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

TELCORDIA TECHNOLOGIES, INC., Plaintiff, v. ALCATEL USA, INC., Defendants. — Civil Action No. 04-874 GMS

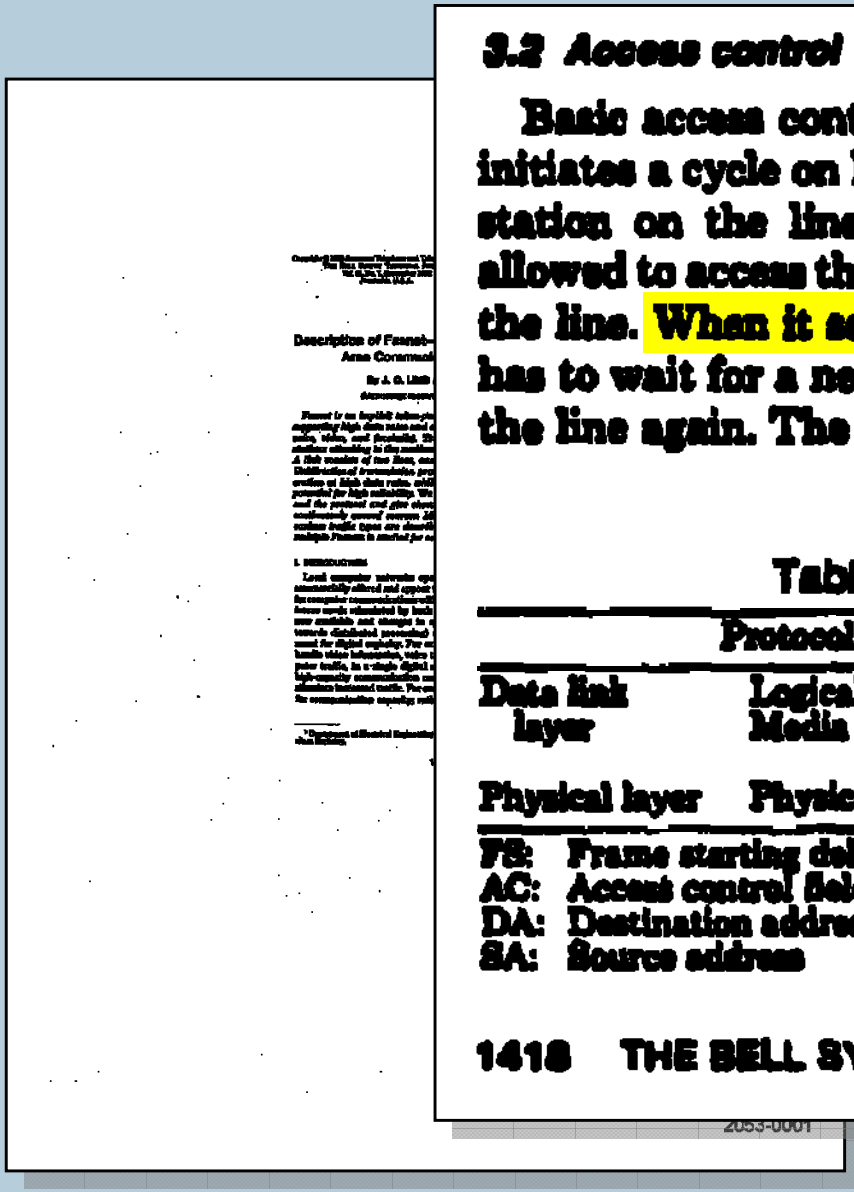
TELCORDIA TECHNOLOGIES, INC., Plaintiff, v. — Civil Action No. 04-875 GMS

35. The terms "available empty payload field" and "empty payload field of any of said frames available to said inserting means" are construed as "an empty payload field that can be filled with a data packet from the source, among the plurality of sources, of the highest priority with a data packet ready to transmit."

Defendants' Trial Exhibit
DTX 2031
C.A. Nos. 04-875, -876 (D. Del.)
2031-0001

DTX 2031

FasNet



3.2 Access control

Basic access control for Fasnet is as follows. The head station, S_1, initiates a cycle on line A. After a cycle has been initiated, each active station on the line with packets destined in the right direction is allowed to access the line for one slot. To do this, each station monitors the line. When it senses the line idle, it seizes the line for one slot. It has to wait for a new cycle to be initiated before it attempts to access the line again. The exact manner in which this is done efficiently and

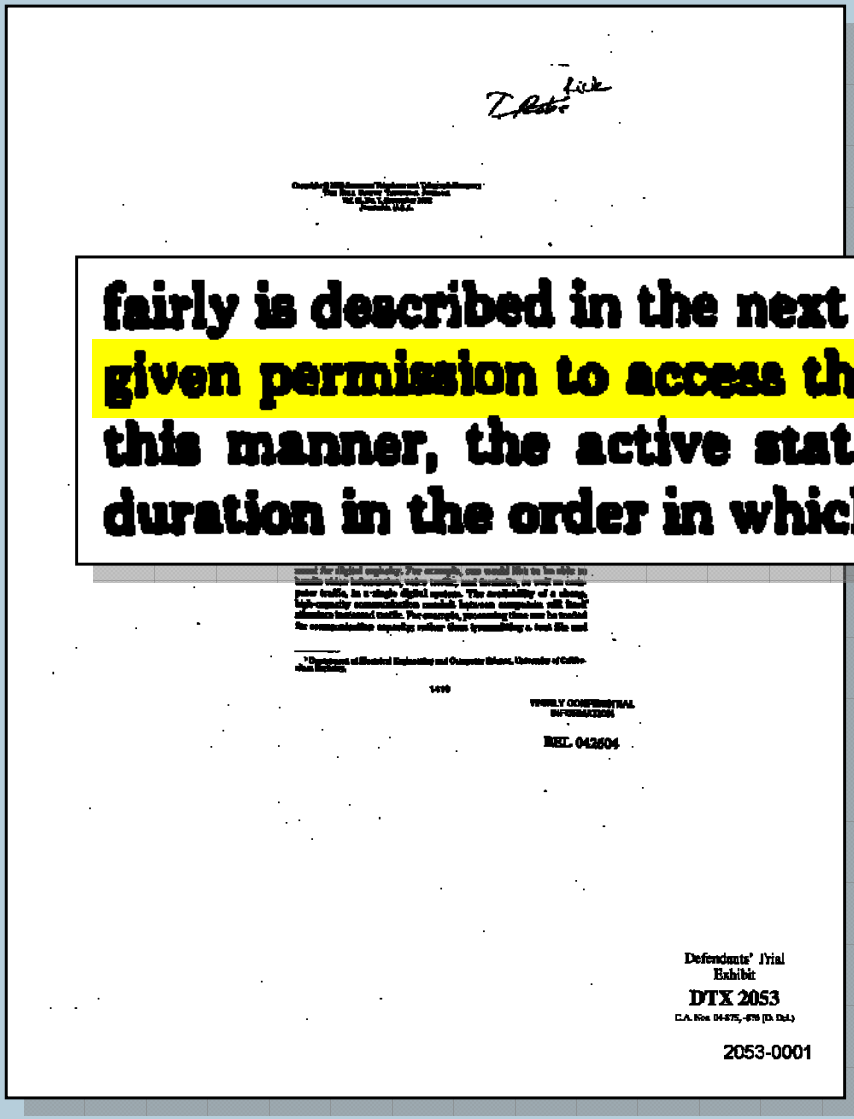
Table I—Protocol and frame structures

Protocol Structure		Frame Structure
Data link layer	Logical link control sublayer	DA/SA/LC/IU
	Media access control sublayer	FS/AC/DA/SA/LC/IU/FCS/FE
Physical layer	Physical layer signaling	FS/AC/DA/SA/LC/IU/FCS/FE

FS: Frame starting delimiter
AC: Access control field
DA: Destination address
SA: Source address
LC: Link control field
IU: Information unit from network layer
FCS: Frame check sequence
FE: Frame ending delimiter

DTX 2053

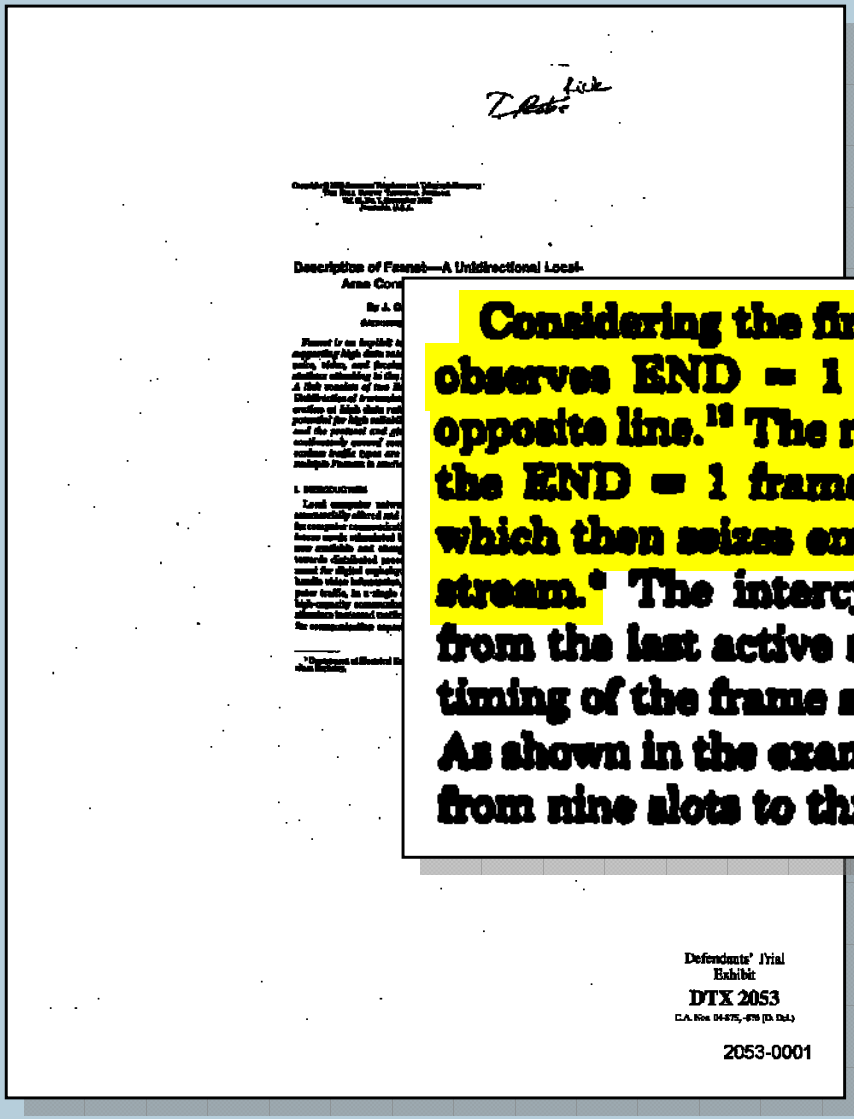
FasNet



fairly is described in the next paragraphs. If a station has priority, it is given permission to access the line for an integral number of slots. In this manner, the active stations can access the line for a specified duration in the order in which they are physically located on the line.

DTX 2053

FasNet

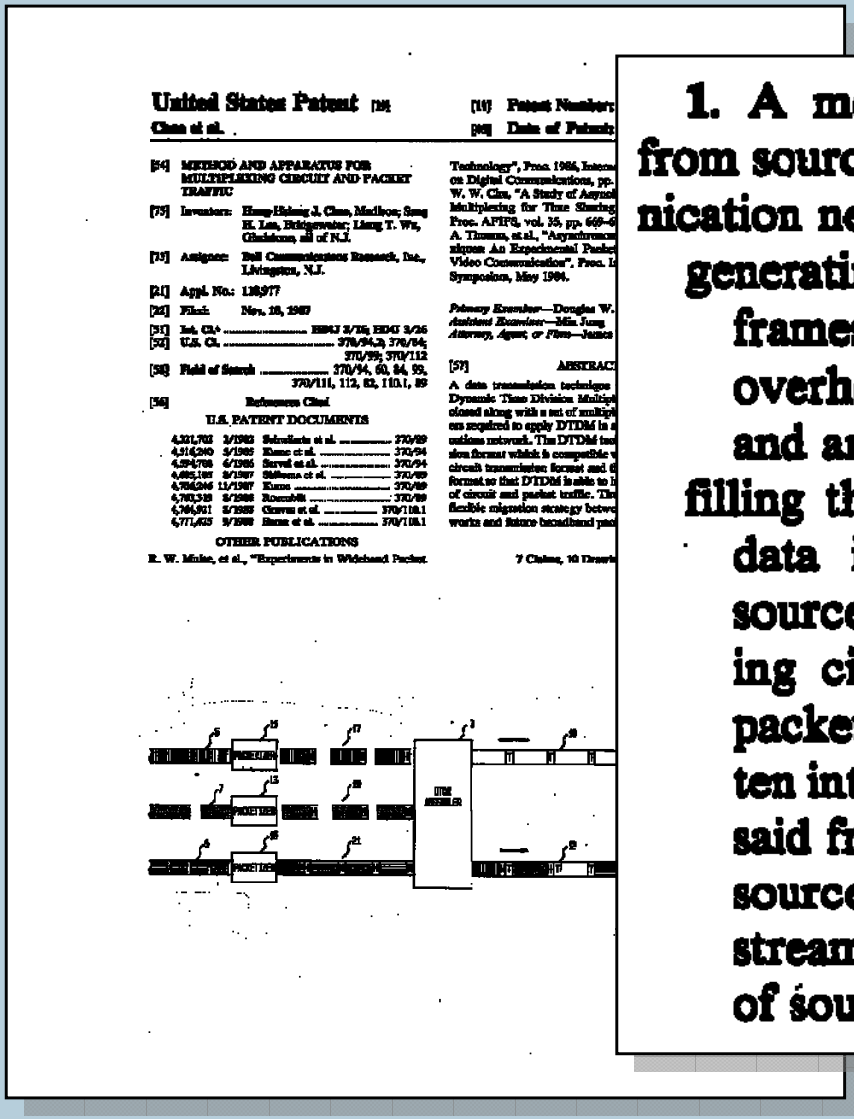


Defendants' Trial Exhibit
DTX 2053
C.A. Nos. 04-875, -876 (D. Del.)
2053-0001

Considering the first method, any station S_i in the WAIT state that observes END = 1 may attempt to seize any empty slots on the opposite line.[11] The number of empty slots seized depends on the time the END = 1 frame takes to propagate to the next active station, which then seizes empty slots, thus preempting active stations downstream.[*] The intercycle gap now depends on the propagation time from the last active station to the end station and back. (The relative timing of the frame starts in the two lines will also affect the gap size). As shown in the example of Fig. 7, the intercycle gap has been reduced from nine slots to three, shown for line A only.

DTX 2053

Claim 1 Of The '306 Patent



United States Patent [19]

Chen et al.

[54] METHOD AND APPARATUS FOR MULTIPLEXING CIRCUIT AND PACKET TRAFFIC

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[21] Appl. No.: 128,977

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[52] U.S. Cl. 370/94.3; 370/94; 370/99; 370/112

[58] Field of Search 370/94, 60, 84, 99, 370/111, 112, 82, 110.1, 85

[56] References Cited

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4,514,840 4/1985 Kunz et al. 370/94
4,594,708 6/1986 Sarvel et al. 370/94
4,685,107 8/1987 Shibuya et al. 370/89
4,704,246 11/1987 Kunz 370/89
4,707,828 8/1988 Rocchetti 370/89
4,766,501 8/1988 Graves et al. 370/110.1
4,771,425 9/1988 Baran et al. 370/110.1

OTHER PUBLICATIONS

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Primary Examiner—Douglas W. Olms
Assistant Examiner—Min Jung
Attorney, Agent, or Firm—James W. Falk

[57] ABSTRACT

A data transmission technique for Dynamic Time Division Multiplexing (DTDM) of a closed ring with a set of multiple stations each of which is required to apply DTDM to a plurality of circuit sources and packet sources in a unitary network. The DTDM technique allows format which is compatible with circuit transmission format and packet format so that DTDM is able to handle both types of circuit and packet traffic. The DTDM technique also provides a flexible migration strategy between present and future broadband packet networks and future broadband packet networks.

7 Claims, 10 Drawing Sheets

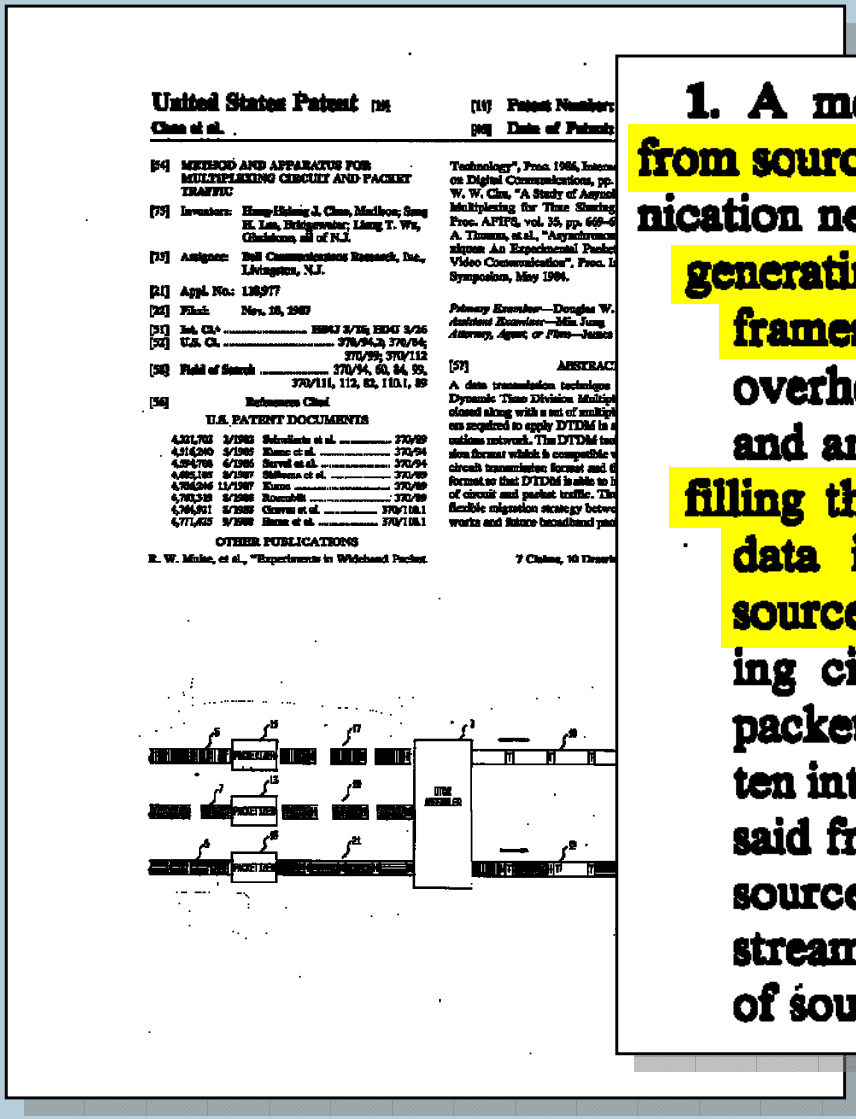
1. A method for simultaneously transmitting data from sources having different bit rates in a telecommunication network comprising the steps of:

generating a bit stream comprising a sequence of frames, each of said frames including a transmission overhead field containing frame timing information and an empty payload field, and

filling the empty payload fields in said frames with data in packetized format from a plurality of sources which have access to the bit stream including circuit or packet sources, such that data in packetized format from any of said sources is written into any available empty payload field of any of said frames for transmitting data from each of said sources at its own desired bit rate via said bit stream and for transmitting data from said plurality of sources simultaneously via said bit stream.

DTX 2002

FasNet Teaches Each Element Of Claim 1 Of The '306 Patent



United States Patent [19]

Chao et al.

[54] METHOD AND APPARATUS FOR MULTIPLEXING CIRCUIT AND PACKET TRAFFIC

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[58] Field of Search 370/94, 60, 84, 99, 370/111, 112, 82, 110.1, 89

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U.S. PATENT DOCUMENTS

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4,414,660	8/1983	Kunz et al.	370/94
4,594,708	6/1986	Servel et al.	370/94
4,685,102	8/1987	Shibuya et al.	370/89
4,704,246	11/1987	Kunz	370/89
4,703,318	8/1988	Rocchetti	370/89
4,766,501	8/1988	Graves et al.	370/110.1
4,771,425	9/1988	Baran et al.	370/110.1

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7 Claims, 10 Drawing Sheets

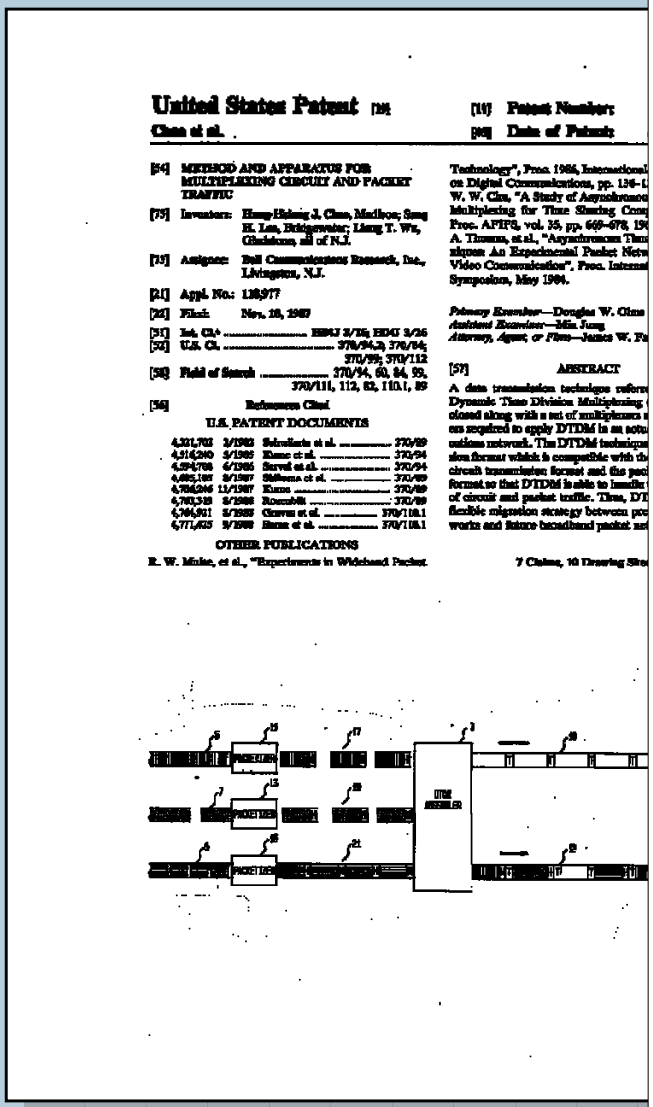
1. A method for simultaneously transmitting data from sources having different bit rates in a telecommunication network comprising the steps of:

generating a bit stream comprising a sequence of frames, each of said frames including a transmission overhead field containing frame timing information and an empty payload field, and

filling the empty payload fields in said frames with data in packetized format from a plurality of sources which have access to the bit stream including circuit or packet sources, such that data in packetized format from any of said sources is written into any available empty payload field of any of said frames for transmitting data from each of said sources at its own desired bit rate via said bit stream and for transmitting data from said plurality of sources simultaneously via said bit stream.

DTX 2002

FasNet Teaches Each Element Of Claim 3 Of The '306 Patent



United States Patent [19]

Chao et al.

[11] Patent Number:

[45] Date of Patent:

[54] METHOD AND APPARATUS FOR MULTIPLEXING CIRCUIT AND PACKET TRAFFIC

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[58] Field of Search 370/94, 60, 84, 99, 370/111, 112, 62, 110.1, 89

[56] References Cited

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4,771,425 9/1988 Baran et al. 370/110.1

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W. W. Chu, "A Study of Asynchronous Time Multiplexing for Time Sharing Computer Systems", Proc. AFIPS, vol. 35, pp. 669-678, 19
A. Thomas, et al., "Asynchronous Time Sequence Network: An Experimental Packet Network Tailored for Video Communication", Proc. International Symposium, May 1984.

Primary Examiner—Douglas W. Olms
Assistant Examiner—Min Jung
Attorney, Agent, or Firm—James W. Falk

[57] ABSTRACT

A data transmission technique referred to as Dynamic Time Division Multiplexing (DTDM) is disclosed along with a set of multiplexers and switches required to apply DTDM in an asynchronous network. The DTDM technique uses a frame format which is compatible with the circuit transmission format and the packet format so that DTDM is able to handle both types of circuit and packet traffic. Thus, DTDM provides a flexible migration strategy between present and future broadband packet networks.

7 Claims, 10 Drawing Sheets

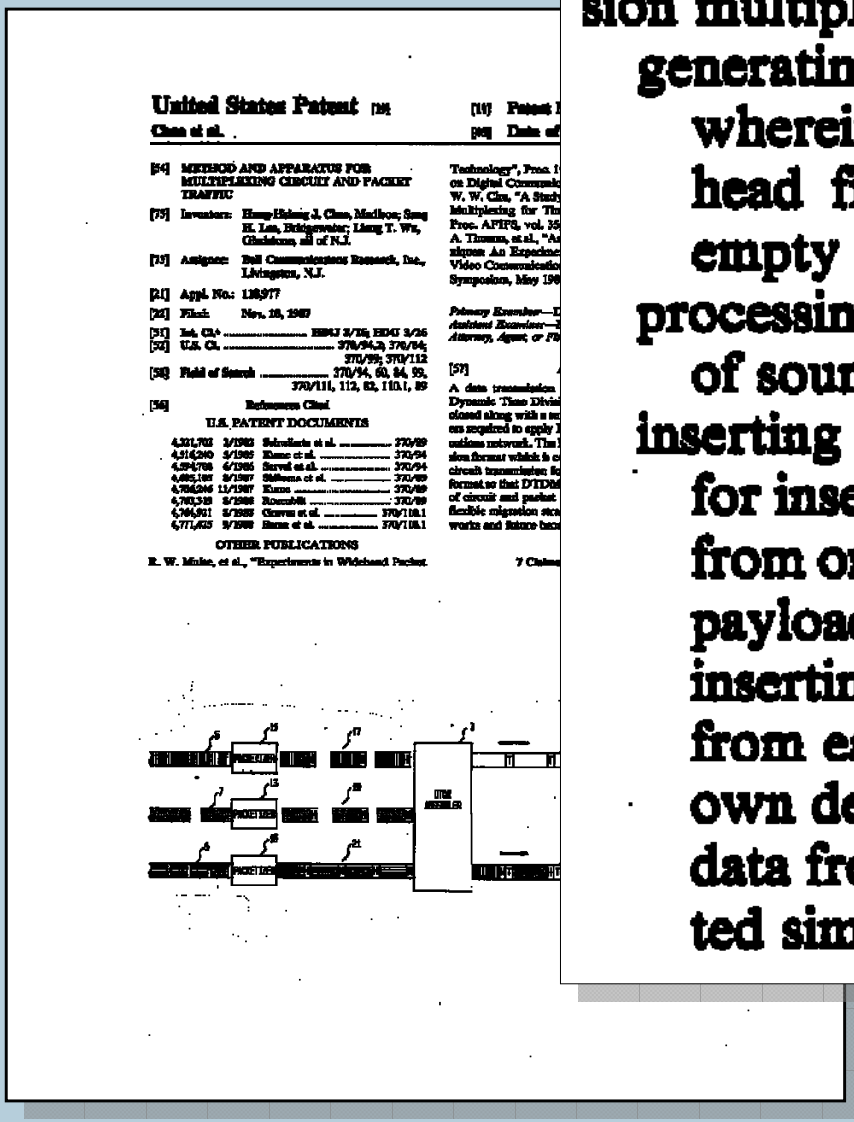
3. A method for generating a bit stream capable of transporting data originating from both circuit transmission and packet sources comprising

generating a bit stream comprising a sequence of frames, each of said frames including a transmission overhead field containing frame timing information and an empty payload field,

packetizing data from a plurality of sources having different bit rates and which have access to said bit stream including circuit transmission sources or customer premises equipment to produce data packets, and

inserting said packets from said sources into the empty payload fields of said frames such that a packet from any of said sources is inserted into any available empty payload field of any of said frames for transmitting data from each of said sources at its own desired bit rate via said bit stream and for transmitting data from said plurality of sources simultaneously using said bit stream.

FasNet Teaches Each Element Of Claim 4 Of The '306 Patent



United States Patent [19]

Chen et al.

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4,766,501	8/1988	Citron et al.	370/110.1
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Primary Examiner—I Assistant Examiner— Attorney, Agent, or Fi

[57] A data transmission Dynamic Time Divi closed ring with a n en required to apply unidirectional network. The slot format which is c circuit transmission fo format so that DTDM of circuit and packet flexible migration sta works and future bro

7 Claims

4. An apparatus for assembling a dynamic time division multiplexing bit stream comprising,

generating means for generating a train of frames wherein each frame includes a transmission overhead field containing timing information and an empty payload field,

processing means for processing data from a plurality of sources into packet format, and

inserting means for receiving said train of frames and for inserting each of said packets comprised of data from one of said plurality of sources into any empty payload field of any of said frames available to said inserting means to form said bit stream so that data from each of said sources can be transmitted at its own desired bit rate via said bit stream and so that data from said plurality of sources can be transmitted simultaneously via said bit stream.

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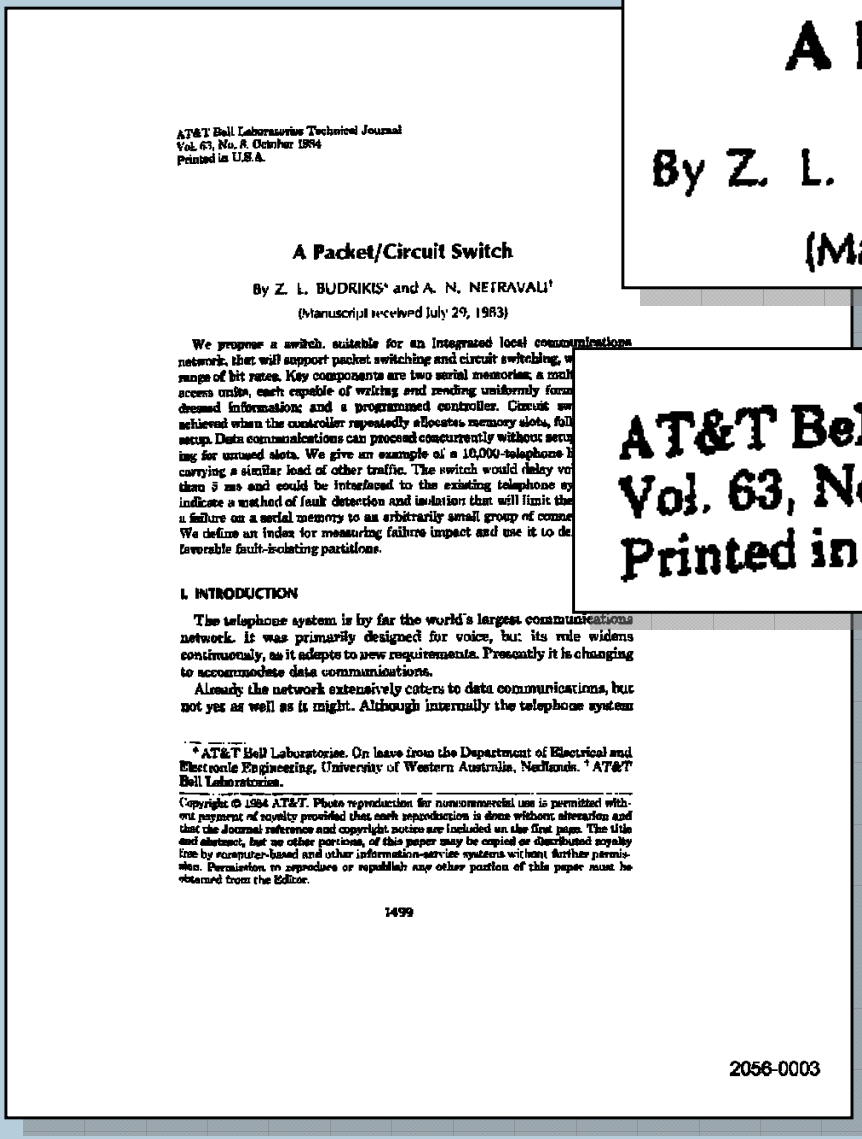

AT&T Bell Laboratories Technical Journal
Vol. 63, No. 8, October 1984
Printed in U.S.A.

A Packet/Circuit Switch

By Z. L. BUDRIKIS* and A. N. NETRAVALI†

(Manuscript received July 29, 1983)

We propose a switch, suitable for an integrated local communications network, that will support packet switching and circuit switching, w
range of bit rates. Key components are two serial memories; a mult
access units, each capable of writing and reading uniformly form
dressed information; and a programmed controller. Circuit sw
achieved when the controller repeatedly allocates memory slots, foll
setup. Data communications can proceed concurrently without secu
ing for unused slots. We give an example of a 10,000-telephone l
carrying a similar load of other traffic. The switch would delay vo
than 5 ms and could be interfaced to the existing telephone sy
indicate a method of fault detection and isolation that will limit the
a failure on a serial memory to an arbitrarily small group of conne
We define an index for measuring failure impact and use it to de
favorable fault-isolating partitions.

I. INTRODUCTION

The telephone system is by far the world's largest communications network. It was primarily designed for voice, but its role widens continuously, as it adapts to new requirements. Presently it is changing to accommodate data communications.

Already the network extensively caters to data communications, but not yet as well as it might. Although internally the telephone system

* AT&T Bell Laboratories. On leave from the Department of Electrical and Electronic Engineering, University of Western Australia, Nedlands. † AT&T Bell Laboratories.

2056-0003

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AT&T Bell Laboratories Technical Journal
Vol. 63, No. 8, October 1984
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DTX 2056

Budrikis

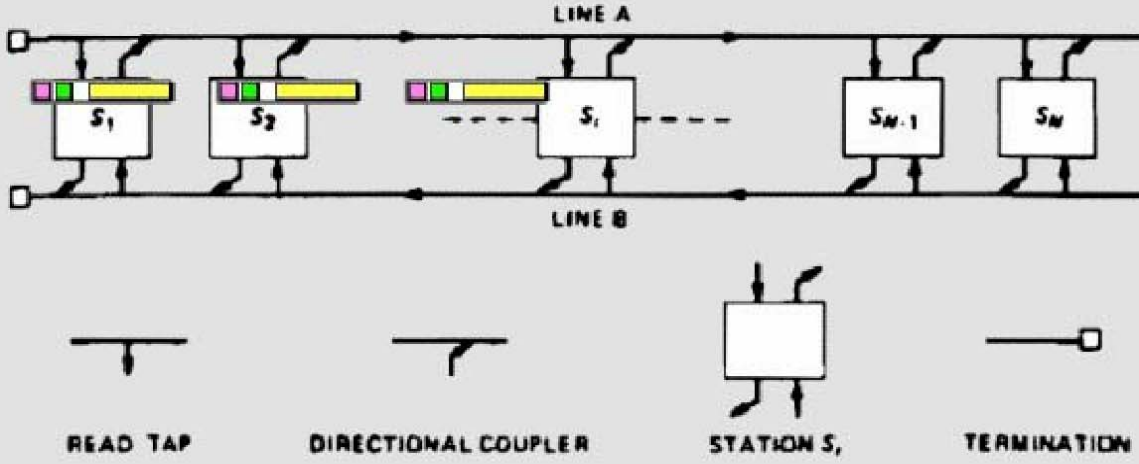


Fig. 2—Physical configuration of a Fasnet link.

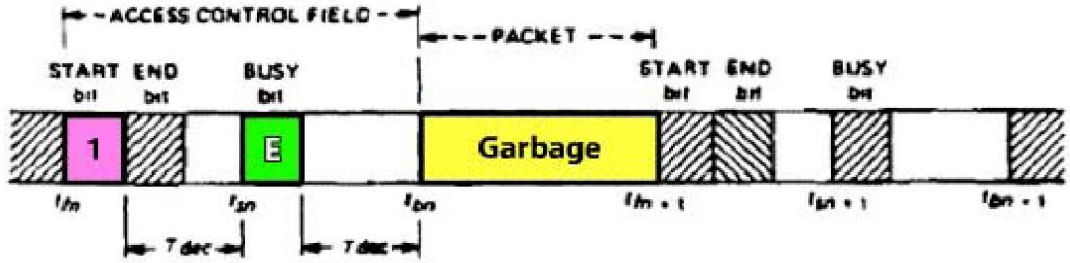
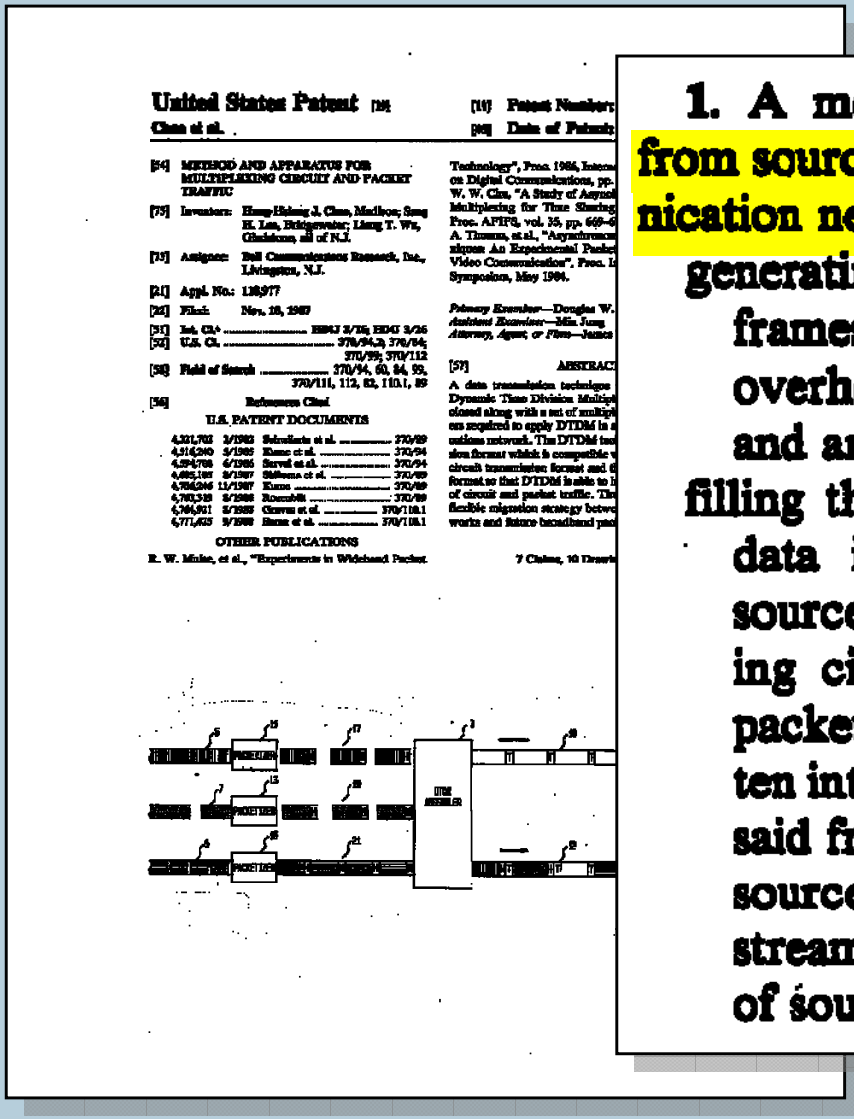


Fig. 3—The frame structure of Fasnet. Each frame consists of (*i*) an access control field containing START, END, and BUSY bits; and (*ii*) the packet as provided by the logical link sublayer.

Claim 1 Of The '306 Patent



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Primary Examiner—Douglas W. Olms
Assistant Examiner—Min Jung
Attorney, Agent, or Firm—James H. Laughlin, Jr.

[57] ABSTRACT

A data transmission technique for Dynamic Time Division Multiplexing (DTDM) of a closed ring with a set of multiplexers each required to apply DTDM to a unique network. The DTDM technique allows format which is compatible with circuit transmission format and packet format so that DTDM is able to handle both of circuit and packet traffic. The flexible migration strategy between works and future broadband

7 Claims, 10 Drawing Sheets

1. A method for simultaneously transmitting data from sources having different bit rates in a telecommunication network comprising the steps of:

generating a bit stream comprising a sequence of frames, each of said frames including a transmission overhead field containing frame timing information and an empty payload field, and

filling the empty payload fields in said frames with data in packetized format from a plurality of sources which have access to the bit stream including circuit or packet sources, such that data in packetized format from any of said sources is written into any available empty payload field of any of said frames for transmitting data from each of said sources at its own desired bit rate via said bit stream and for transmitting data from said plurality of sources simultaneously via said bit stream.

DTX 2002

Budrikis

We propose a switch, suitable for an integrated local communications network, that will support packet switching and circuit switching, with a wide range of bit rates. Key components are two serial memories; a multiplicity of access units, each capable of writing and reading uniformly formatted, addressed information; and a programmed controller. Circuit switching is achieved when the controller repeatedly allocates memory slots, following call setup. Data communications can proceed concurrently without setup, competing for unused slots. We give an example of a 10,000-telephone-line switch carrying a similar load of other traffic. The switch would delay voice by less than 5 ms and could be interfaced to the existing telephone system. We indicate a method of fault detection and isolation that will limit the impact of a failure on a serial memory to an arbitrarily small group of connected lines. We define an index for measuring failure impact and use it to derive most-favorable fault-isolating partitions.

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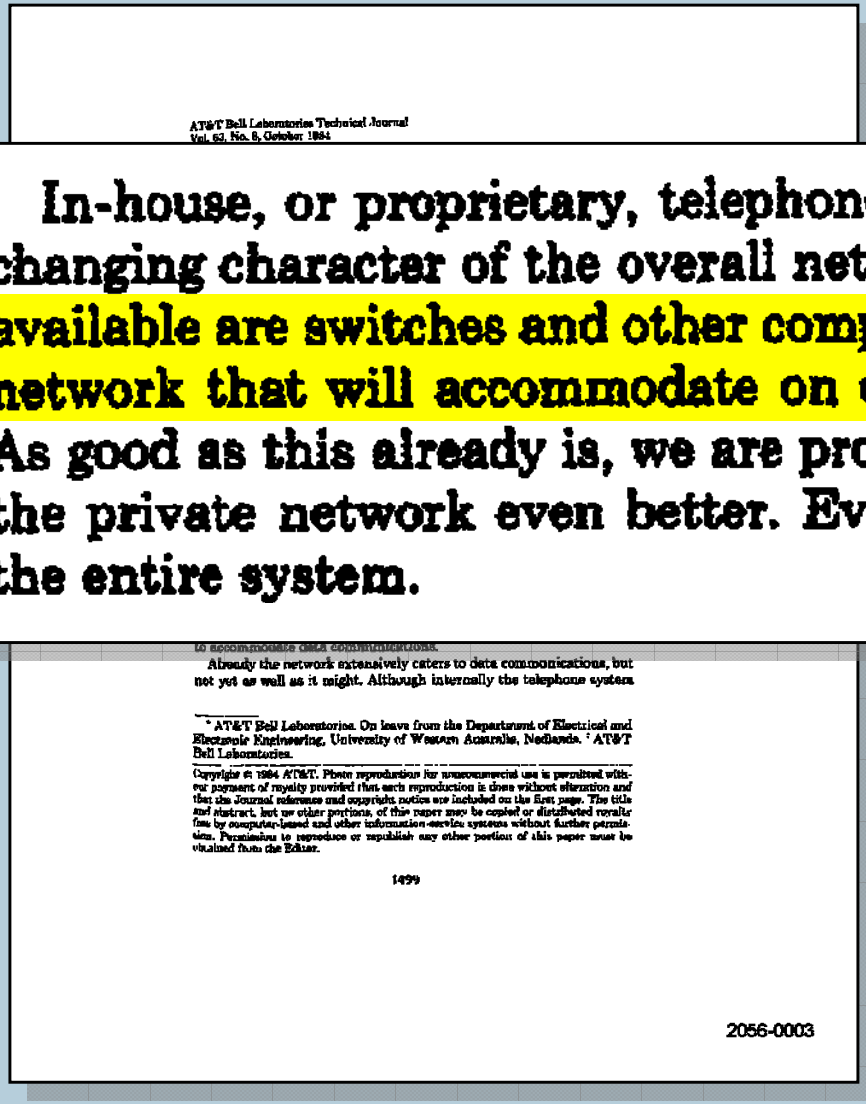
Budrikis



AT&T Bell Laboratories Technical Journal
Vol. 63, No. 8, October 1984

In-house, or proprietary, telephone networks can benefit from the changing character of the overall network more immediately. Already available are switches and other components that permit an all-digital network that will accommodate on one facility both voice and data. As good as this already is, we are proposing a switch that could make the private network even better. Eventually it might even influence the entire system.

to accommodate data communications.

Already the network extensively caters to data communications, but not yet as well as it might. Although internally the telephone system

* AT&T Bell Laboratories. On leave from the Department of Electrical and Electronic Engineering, University of Western Australia, Nedlands. † AT&T Bell Laboratories.

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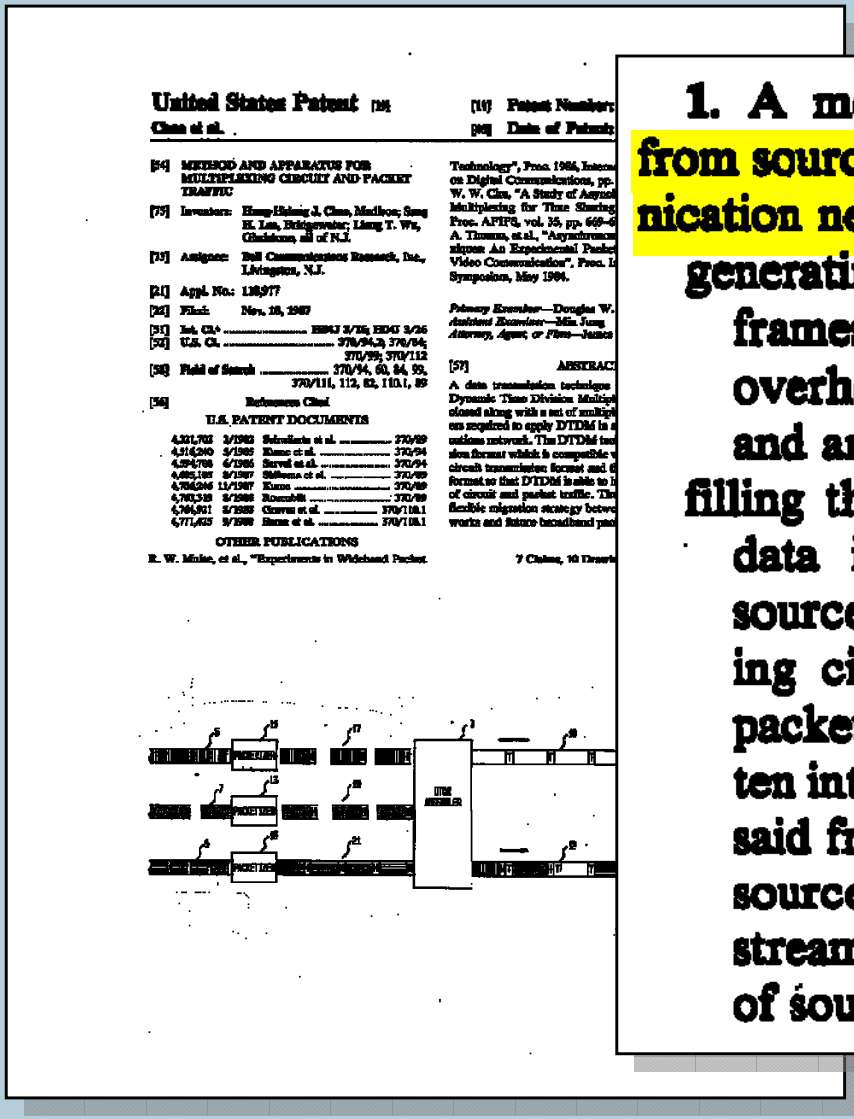
Claim 1 Of The '306 Patent



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[58] Field of Search 370/94, 60, 84, 99, 370/111, 112, 82, 110.1, 85

[56] References Cited

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A. Thomas, et al., "Asynchronous Time-Division Techniques: An Experimental Packet System", Proc. International Zurich Seminar on Digital Communication, Proc. International Switching Symposium, May 1984.

Primary Examiner—Douglas W. Olms
Assistant Examiner—Min Jung
Attorney, Agent, or Firm—James W. Falk

[57] ABSTRACT

A data transmission technique for Dynamic Time Division Multiplexing with a set of multiplexers and a switch required to apply DTDM in a unitary network. The DTDM technique allows format which is compatible with circuit transmission format and packet format so that DTDM is able to handle both of circuit and packet traffic. The flexible migration strategy between works and future broadband

7 Claims, 10 Drawing Sheets

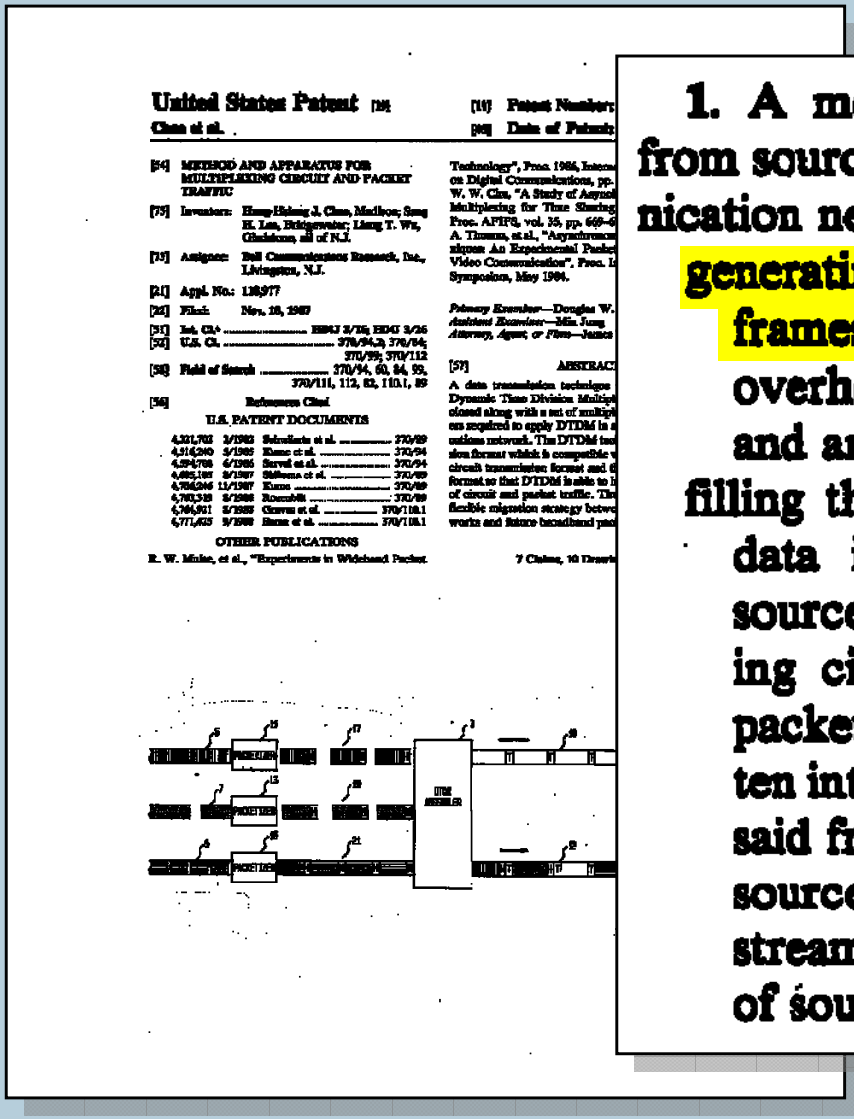
1. A method for simultaneously transmitting data from sources having different bit rates in a telecommunication network comprising the steps of:

generating a bit stream comprising a sequence of frames, each of said frames including a transmission overhead field containing frame timing information and an empty payload field, and

filling the empty payload fields in said frames with data in packetized format from a plurality of sources which have access to the bit stream including circuit or packet sources, such that data in packetized format from any of said sources is written into any available empty payload field of any of said frames for transmitting data from each of said sources at its own desired bit rate via said bit stream and for transmitting data from said plurality of sources simultaneously via said bit stream.

DTX 2002

Claim 1 Of The ’306 Patent



United States Patent [19]

Chen et al.

[54] METHOD AND APPARATUS FOR MULTIPLEXING CIRCUIT AND PACKET TRAFFIC

[75] Inventors: Hung-Hsiang J. Chen, Marlboro; Sung H. Lee, Bridgewater; Liang T. Wu, Gladstone, all of N.J.

[73] Assignee: Bell Communications Research, Inc., Livingston, N.J.

[21] Appl. No.: 128,977

[22] Filed: Nov. 18, 1987

[51] Int. Cl.[4] H04J 3/16; H04J 3/26

[52] U.S. Cl. 370/94.3; 370/94; 370/99; 370/112

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Primary Examiner—Douglas W. Olms
Assistant Examiner—Min Jung
Attorney, Agent, or Firm—James H. Laughlin, Jr.

[57] ABSTRACT

A data transmission technique for Dynamic Time Division Multiplexing of a plurality of sources with a set of multiplexing rates is disclosed. The technique is required to apply DTDM in a wideband integrated voice/data communications network. The DTDM technique utilizes a frame format which is compatible with the conventional synchronous circuit transmission format and the conventional packet format so that DTDM is able to handle both types of circuit and packet traffic. The technique provides a flexible migration strategy between the current synchronous circuit networks and future broadband packet networks.

7 Claims, 10 Drawing Sheets

1. A method for simultaneously transmitting data from sources having different bit rates in a telecommunication network comprising the steps of:

generating a bit stream comprising a sequence of frames, each of said frames including a transmission overhead field containing frame timing information and an empty payload field, and

filling the empty payload fields in said frames with data in packetized format from a plurality of sources which have access to the bit stream including circuit or packet sources, such that data in packetized format from any of said sources is written into any available empty payload field of any of said frames for transmitting data from each of said sources at its own desired bit rate via said bit stream and for transmitting data from said plurality of sources simultaneously via said bit stream.

DTX 2002

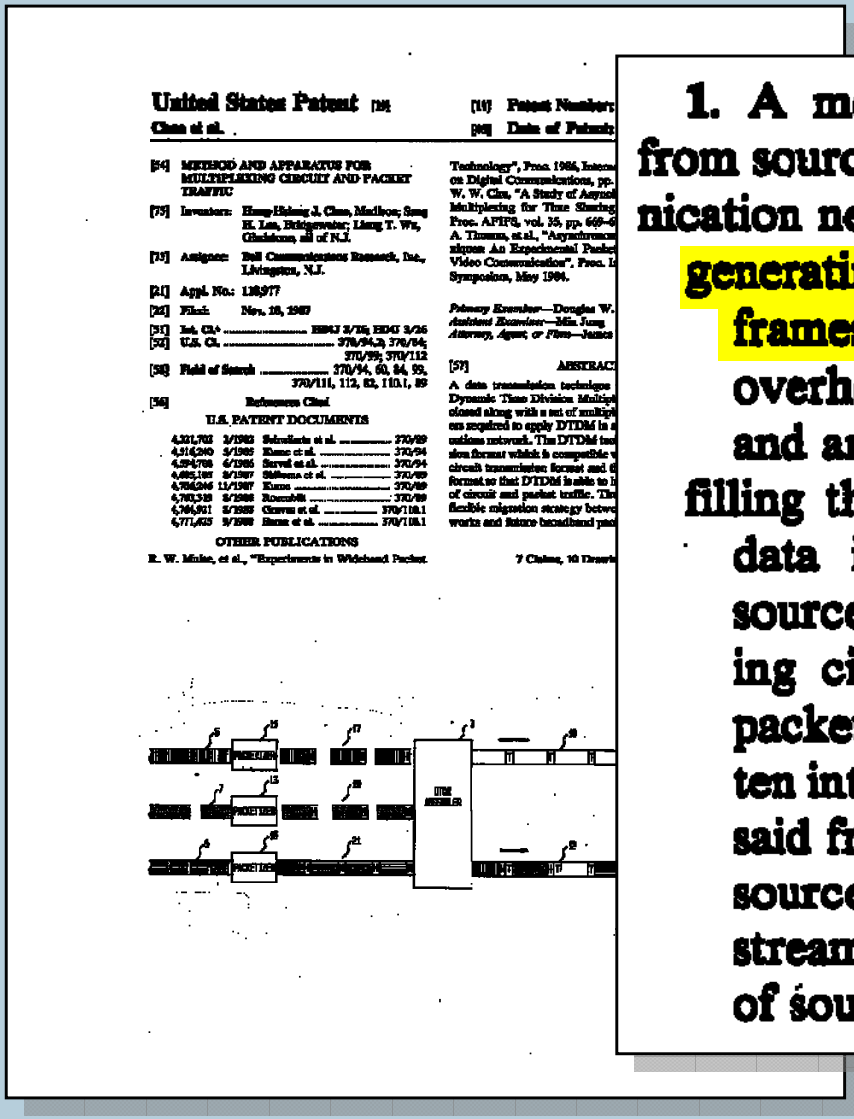
Claim 1 Of The '306 Patent

An AU acts as an agent of a client station (St) (e.g., telephone, facsimile terminal, computer) and mediates communications between it and other stations by way of corresponding AUs. Communications are carried on by write-and-reads in memory/time slots of uniform length and format. Each slot consists of a data field and several control fields. Collectively, the control fields provide synchronization, "Slot

BUSY – SLOT BUSY FIELD
RQST – SLOT REQUEST FIELD
SNDR – SENDER ADDRESS
RCVR – RECEIVER ADDRESS
DATA – DATA FIELD
SYNC – SYNCHRONIZATION FIELD

Fig. 5—Slot format. Typically, BUSY, RQST and SYNC would be one-bit fields, the address fields could be two bytes each and the data field 24 bytes.

Claim 1 Of The '306 Patent



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DTX 2002

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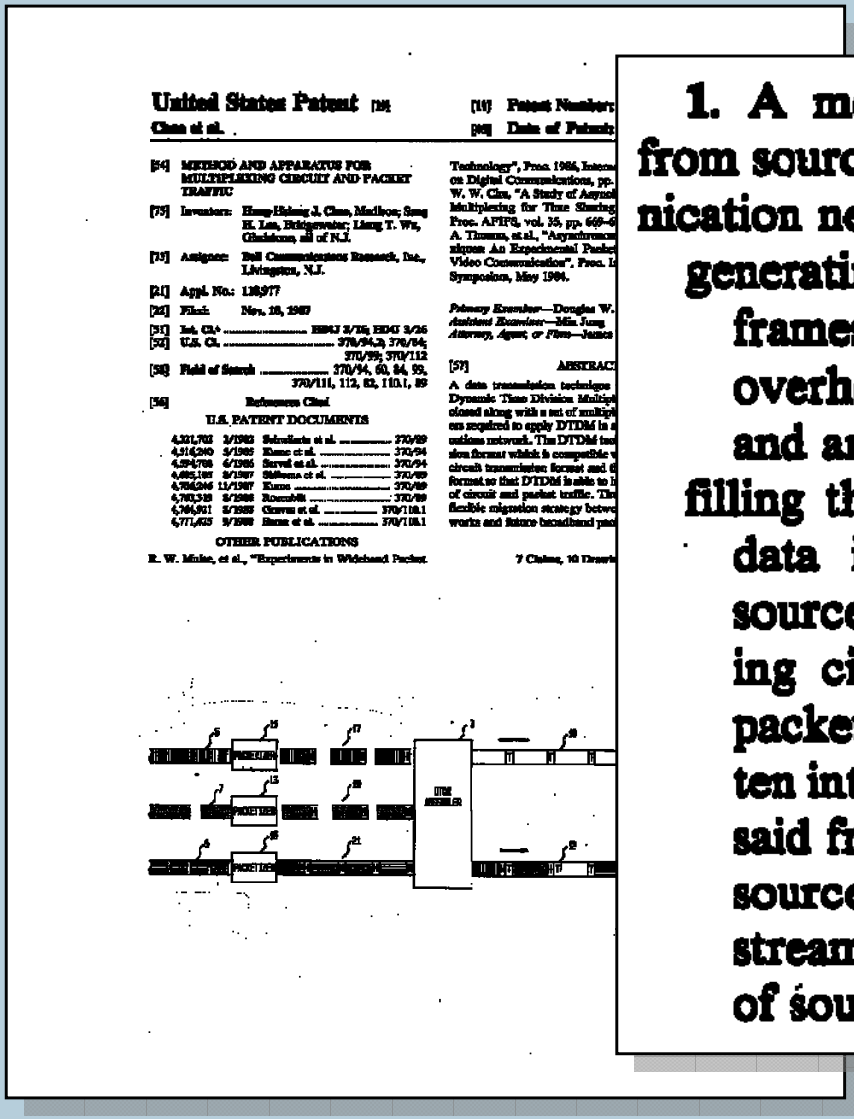

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DTX 2002

6. SYNC—synchronization field.

The roles of all the fields, except RQST and SYNC, are self-evident. RQST is used by packet-switching AUs and we will see its function presently when we discuss data communications. The SYNC field is written by the central controller to ensure slot and frame synchronization. Although both synchronizations could be achieved with just one bit per slot, a field of two bits will make them more secure. Altogether, the following numbers would be of the right order: BUSY and RQST one bit each, SYNC two bits, the addresses 14 bits each, and DATA 192 bits, for a total packet of 224 bits, or 28 bytes.

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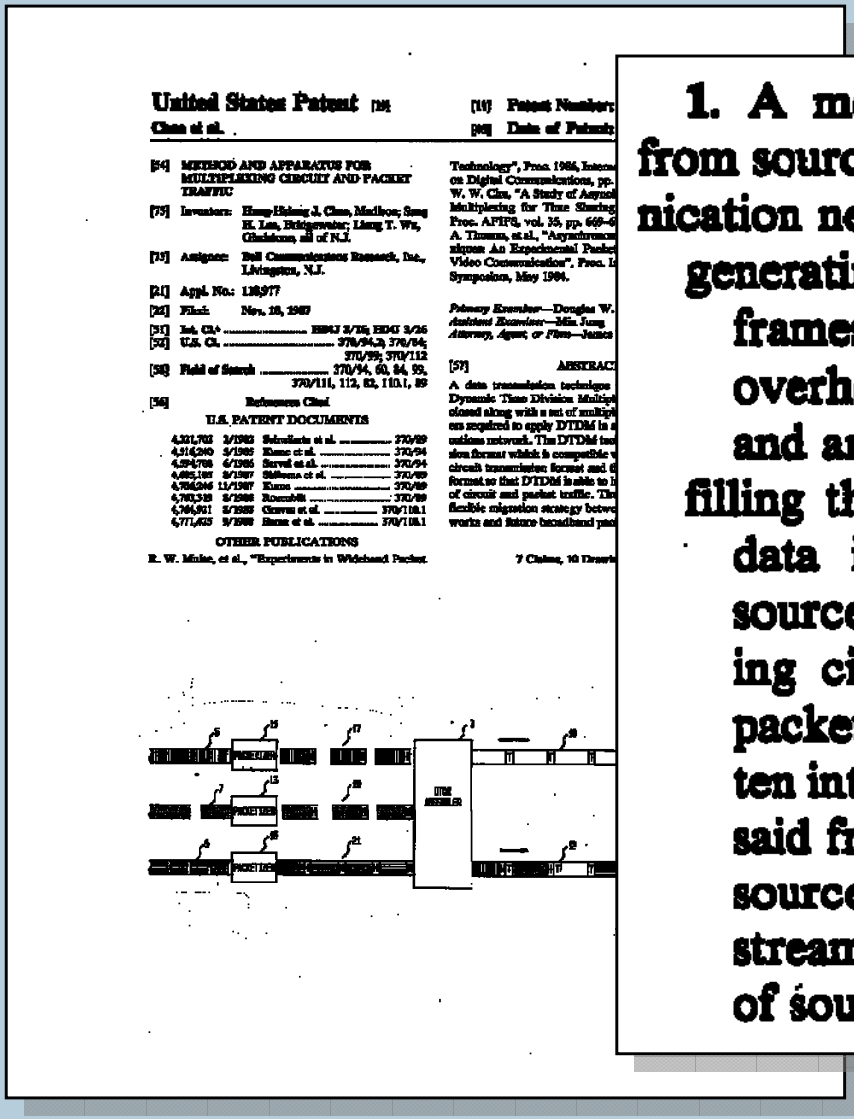
Claim 1 Of The ’306 Patent



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DTX 2002

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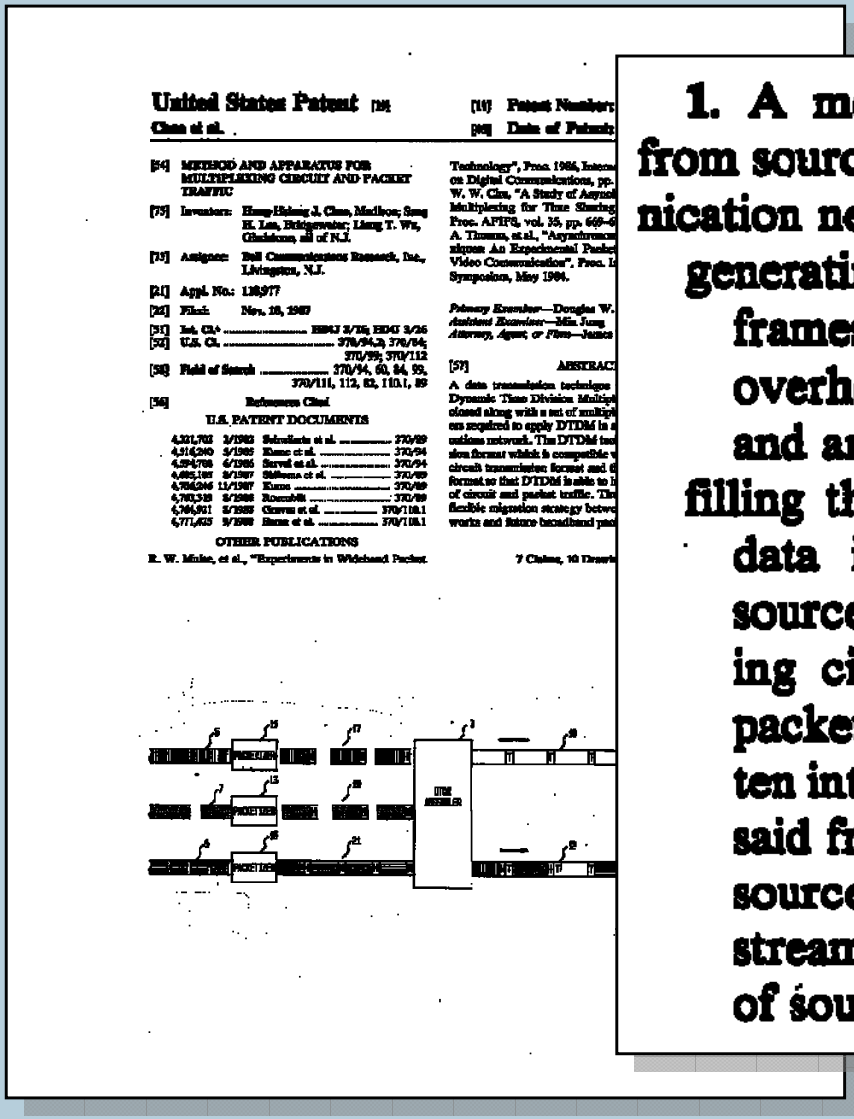

United States Patent [19]

Chen et al.

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[21] Appl. No.: 128,977

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[51] Int. Cl.[4] H04J 3/16; H04J 3/26

[52] U.S. Cl. 370/94.3; 370/94; 370/99; 370/112

[58] Field of Search 370/94, 60, 84, 99, 370/111, 112, 62, 110.1, 85

[56] References Cited

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4,685,107 8/1987 Shibuya et al. 370/89
4,704,246 11/1987 Kunz 370/89
4,703,321 8/1988 Rosenthal 370/89
4,766,501 8/1988 Gitman et al. 370/110.1
4,771,425 9/1988 Baran et al. 370/110.1

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[57] ABSTRACT

A data transmission technique ... Dynamic Time Division Multiplexing ... closed ring with a set of multiplexers ... as required to apply DTDM ... nations network. The DTDM technique ... slow format which is compatible ... circuit transmission format and ... format so that DTDM is able to ... of circuit and packet traffic. The ... flexible migration strategy between ... works and future broadband ...

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DTX 2002

Budrikis

AT&T Bell Laboratories Technical Journal
Vol. 63, No. 8, October 1984
Printed in U.S.A.

A Packet/Circuit Switch

By Z. L. BUDRIKIS* and A. N. NETRAVALI†

When idle, the dispatcher is normally in the "Go" state and monitors the sending buffer (for the forward channel), checking whether it contains a packet for transmission. If it does, it reads the BUSY field of the next block on the forward channel and at the same time writes a "ONE" in that field so as to seize the slot, should it be available. If it is not, i.e., BUSY was already "ONE," then it will write "ONE" in the next RQST field on the reverse channel and wait for the next BUSY field on the forward channel. It will repeat reading and writing of BUSY on the forward channel and sending RQSTs on the reverse channel until a "ZERO" BUSY occurs. It will then write in the related

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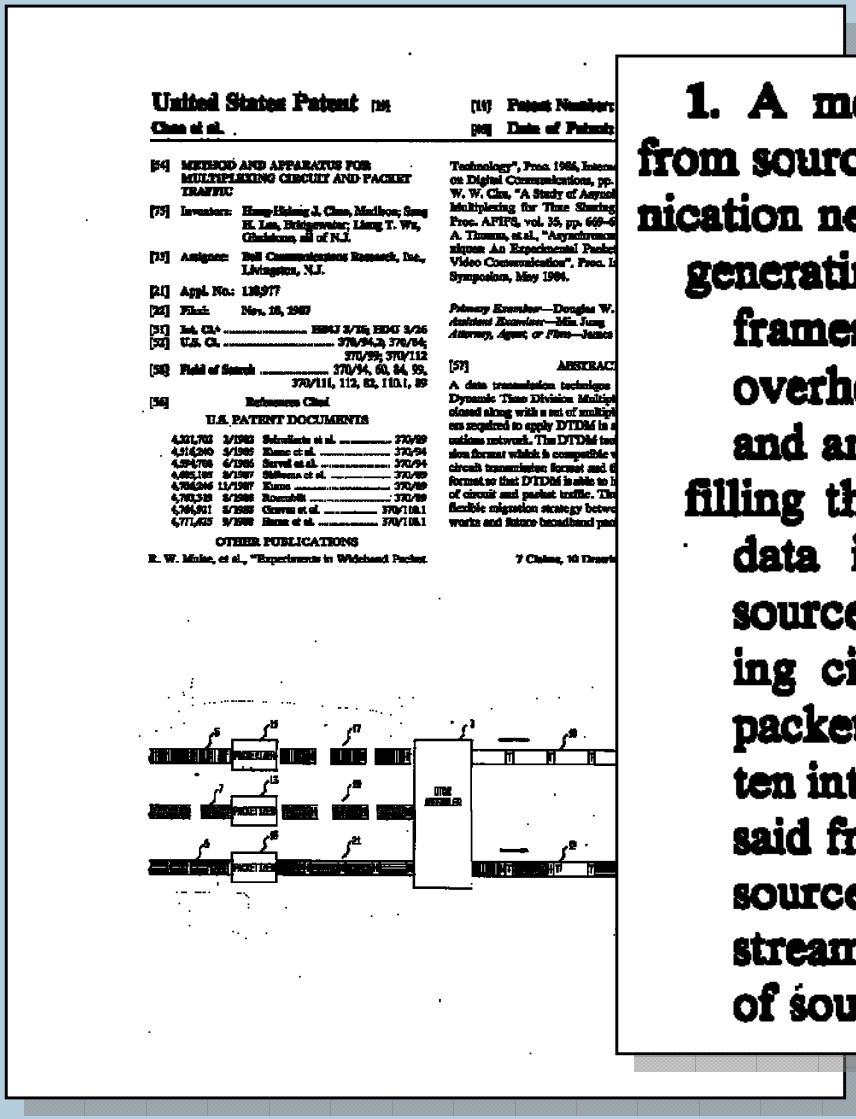
Claim 1 Of The ’306 Patent



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Primary Examiner—Douglas W. ...
Assistant Examiner—Min Jung
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[57] ABSTRACT

A data transmission technique ... Dynamic Time Division Multiplexing ... closed ring with a set of multiplexers ... are required to apply DTDM in a ... nations network. The DTDM technique ... slot format which is compatible with ... circuit transmission format and ... format so that DTDM is able to ... of circuit and packet traffic. The ... flexible migration strategy between ... works and future broadband ...

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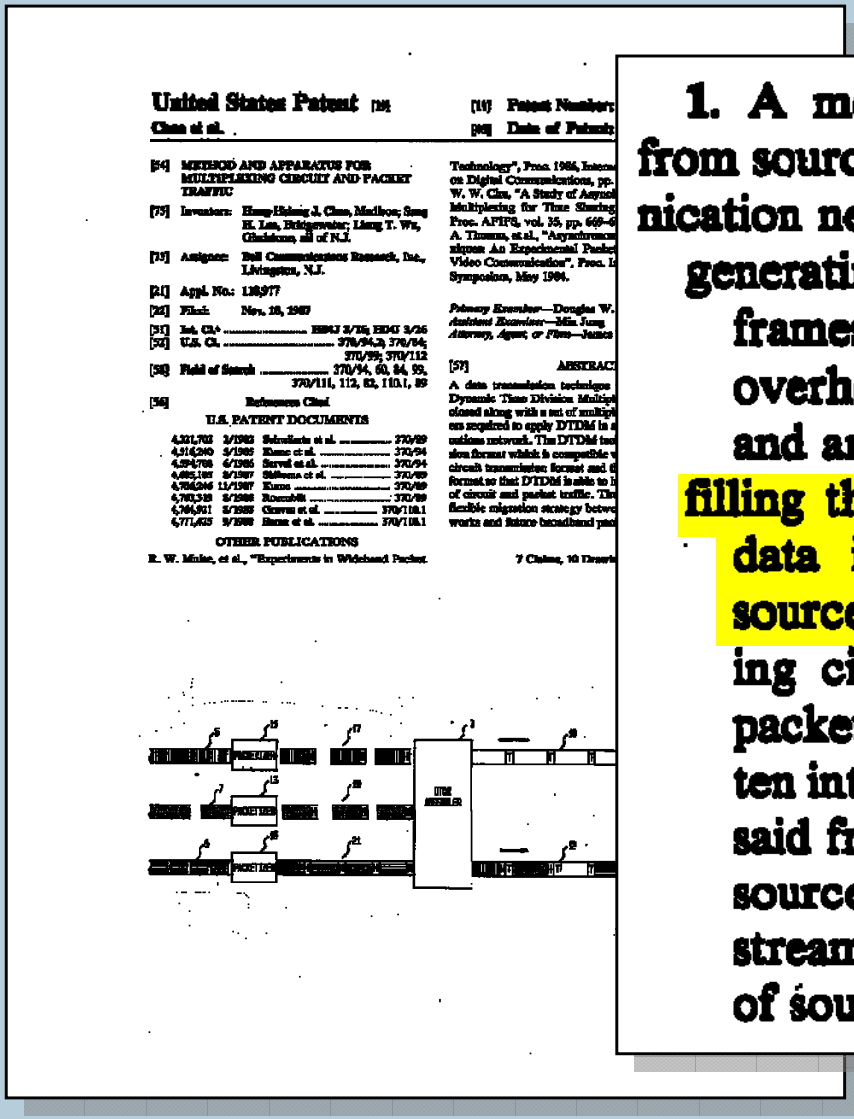

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4,744,081 5/1988 Gawen et al. 370/110.1
4,771,425 9/1988 Baran et al. 370/110.1

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Assistant Examiner—Min Jung
Attorney, Agent, or Firm—James H. Laughlin, Jr.

[57] ABSTRACT

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7 Claims, 10 Drawing Sheets

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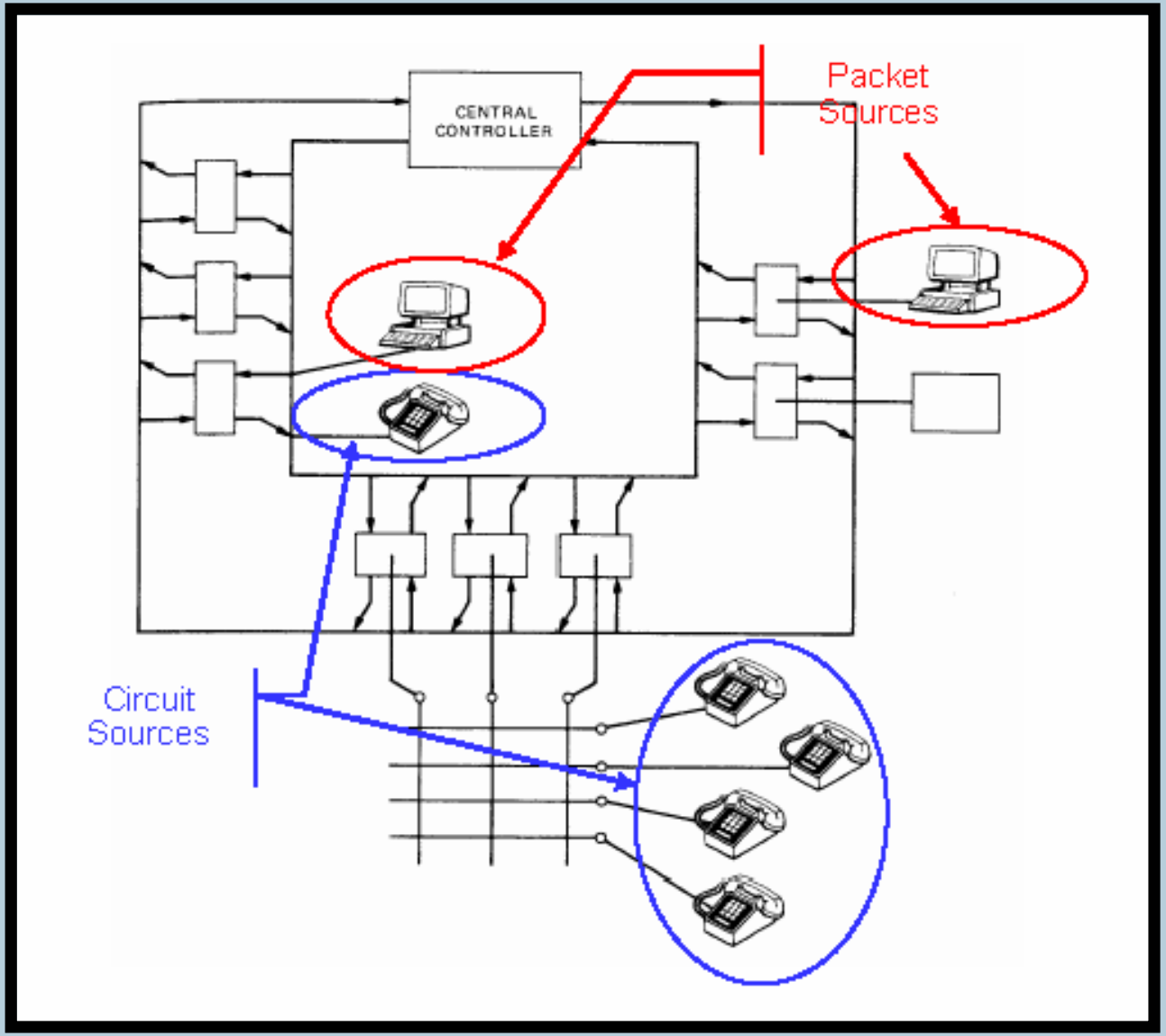
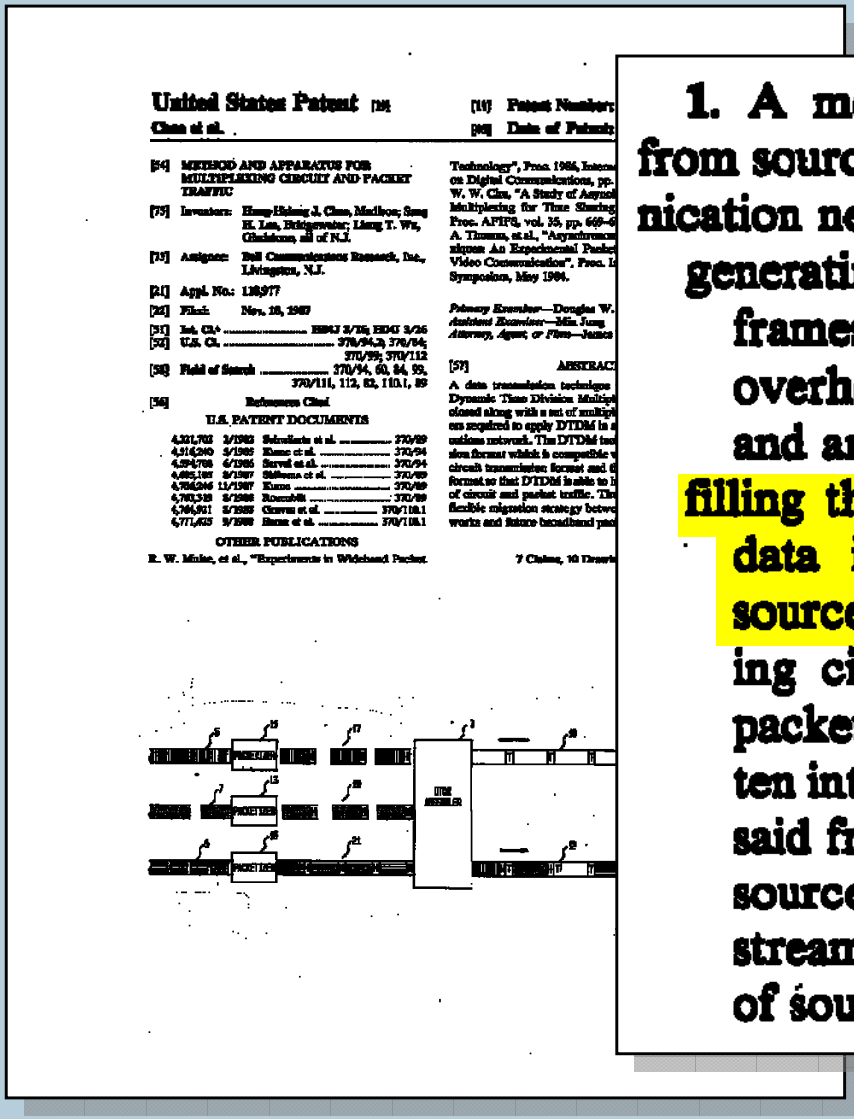


DTX 2056

Claim 1 Of The ’306 Patent



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DTX 2002

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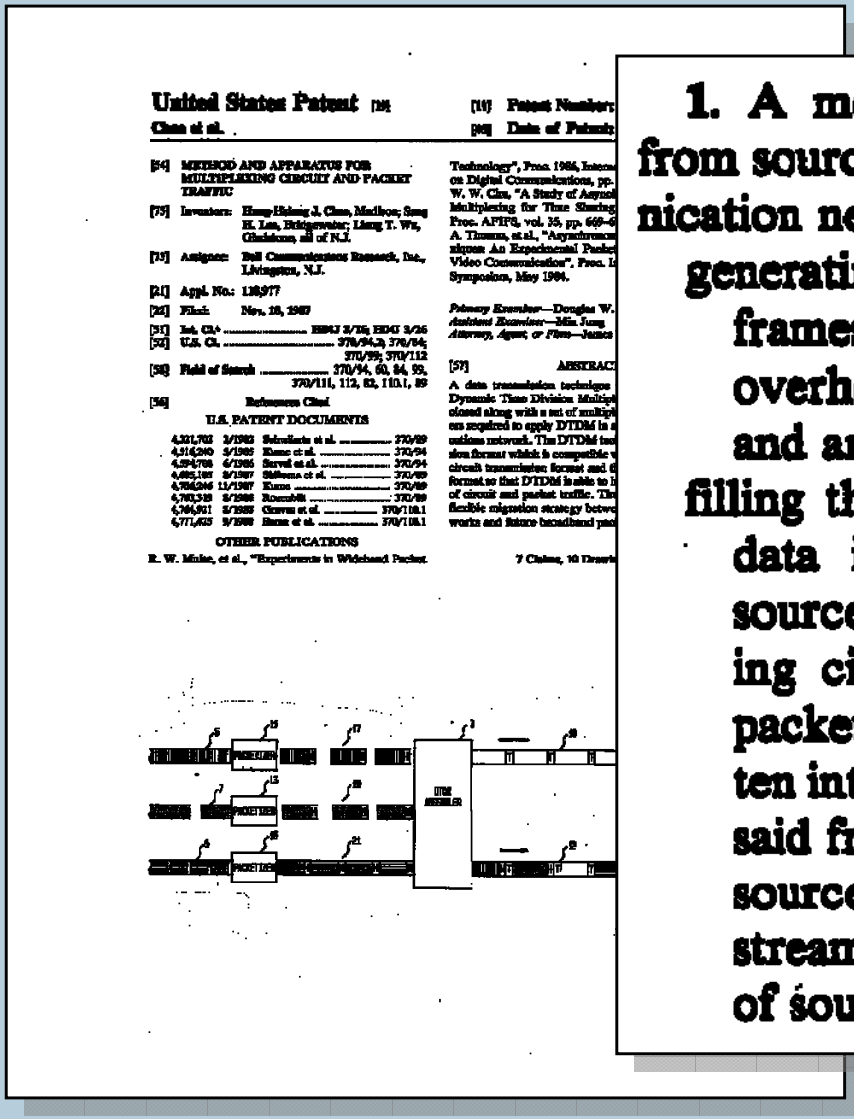

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DTX 2002

The Court's interpretation: "available empty payload field"

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

TELCORDIA TECHNOLOGIES, INC., Plaintiff, v. ALCATEL USA, INC., Defendants. — Civil Action No. 04-874 GMS

TELCORDIA TECHNOLOGIES, INC., Plaintiff, v. — Civil Action No. 04-875 GMS

35. The terms "available empty payload field" and "empty payload field of any of said frames available to said inserting means" are construed as "an empty payload field that can be filled with a data packet from the source, among the plurality of sources, of the highest priority with a data packet ready to transmit."

Defendants' Trial Exhibit
DTX 2031
C.A. Nos. 04-875, -876 (D. Del.)
2031-0001

DTX 2031

Budrikis

AT&T Bell Laboratories Technical Journal
Vol. 63, No. 8, October 1984
Printed in U.S.A.

A Packet/Circuit Switch

By Z. L. BUDRIKIS* and A. N. NETRAVALI†

(Manuscript received July 29, 1983)

We propose a switch, suitable for an integrated local communications network, that will support packet switching and circuit switching, with a wide range of bit rates. Key components are two serial memories: a multiplicity of access units, each capable of writing and reading uniformly formatted, addressed information; and a programmed controller. Circuit switching is achieved when the controller repeatedly allocates memory slots, following call setup. Data communications can proceed concurrently without setup, competing for unused slots. We give an example of a 10,000-telephone-line switch carrying a similar load of other traffic. The switch would delay voice by less than 5 ms and could be interfaced to the existing telephone system. We indicate a method of fault detection and isolation that will limit the impact of a failure on a serial memory to an arbitrarily small group of connected lines. We define an index for measuring failure impact and use it to derive most-favorable fault-isolating partitions.

I. INTRODUCTION

The telephone system is by far the world's largest communications network. It was primarily designed for voice, but its role widens continuously, as it adapts to new requirements. Presently it is changing to accommodate data communications.

Already the network extensively caters to data communications, but not yet as well as it might. Although internally the telephone system

* AT&T Bell Laboratories. On leave from the Department of Electrical and Electronic Engineering, University of Western Australia, Nedlands. † AT&T Bell Laboratories.

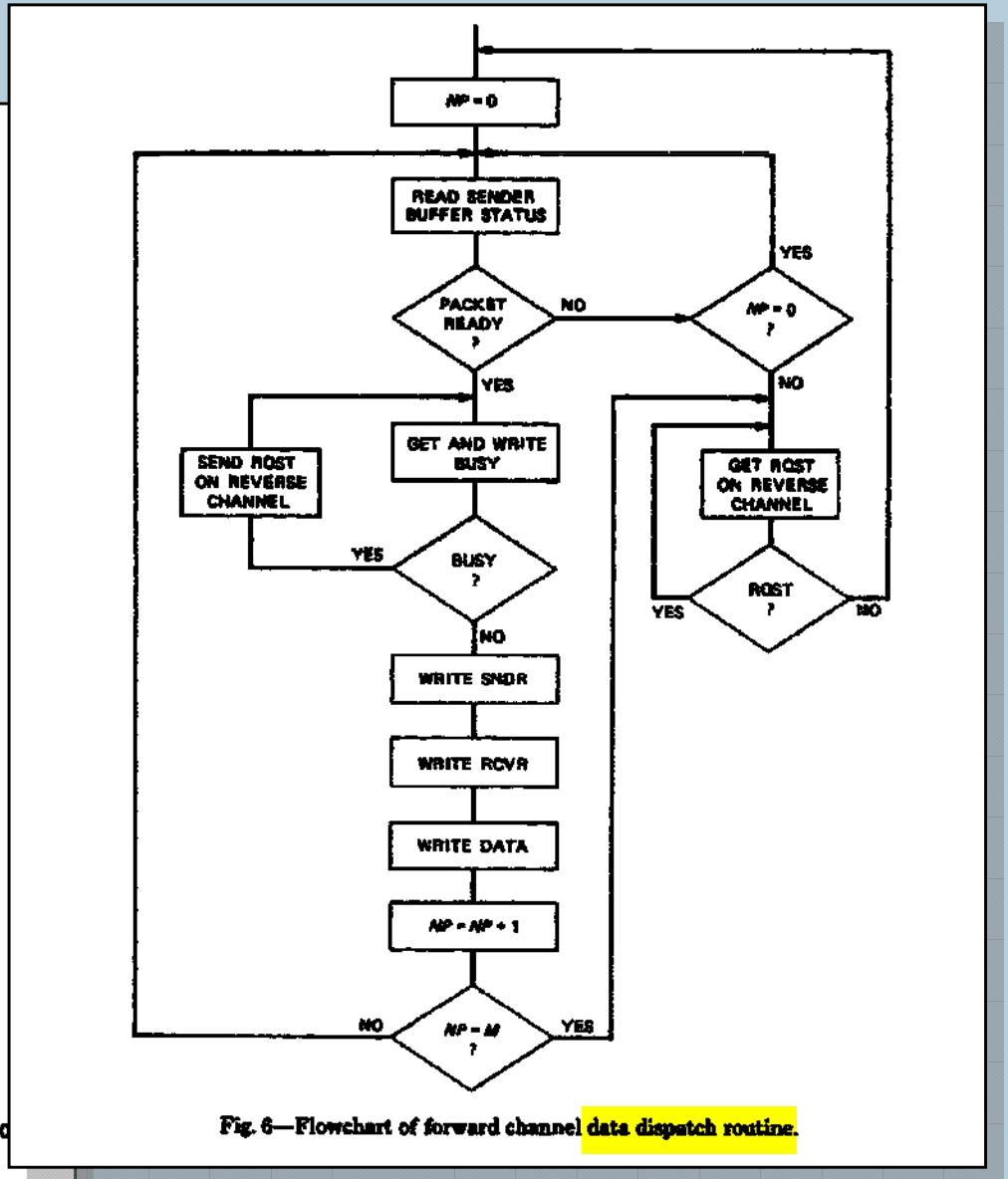


Fig. 6—Flowchart of forward channel data dispatch routine.

DTX 2056

Budrikis

Check buffer to see if a packet is ready to transmit

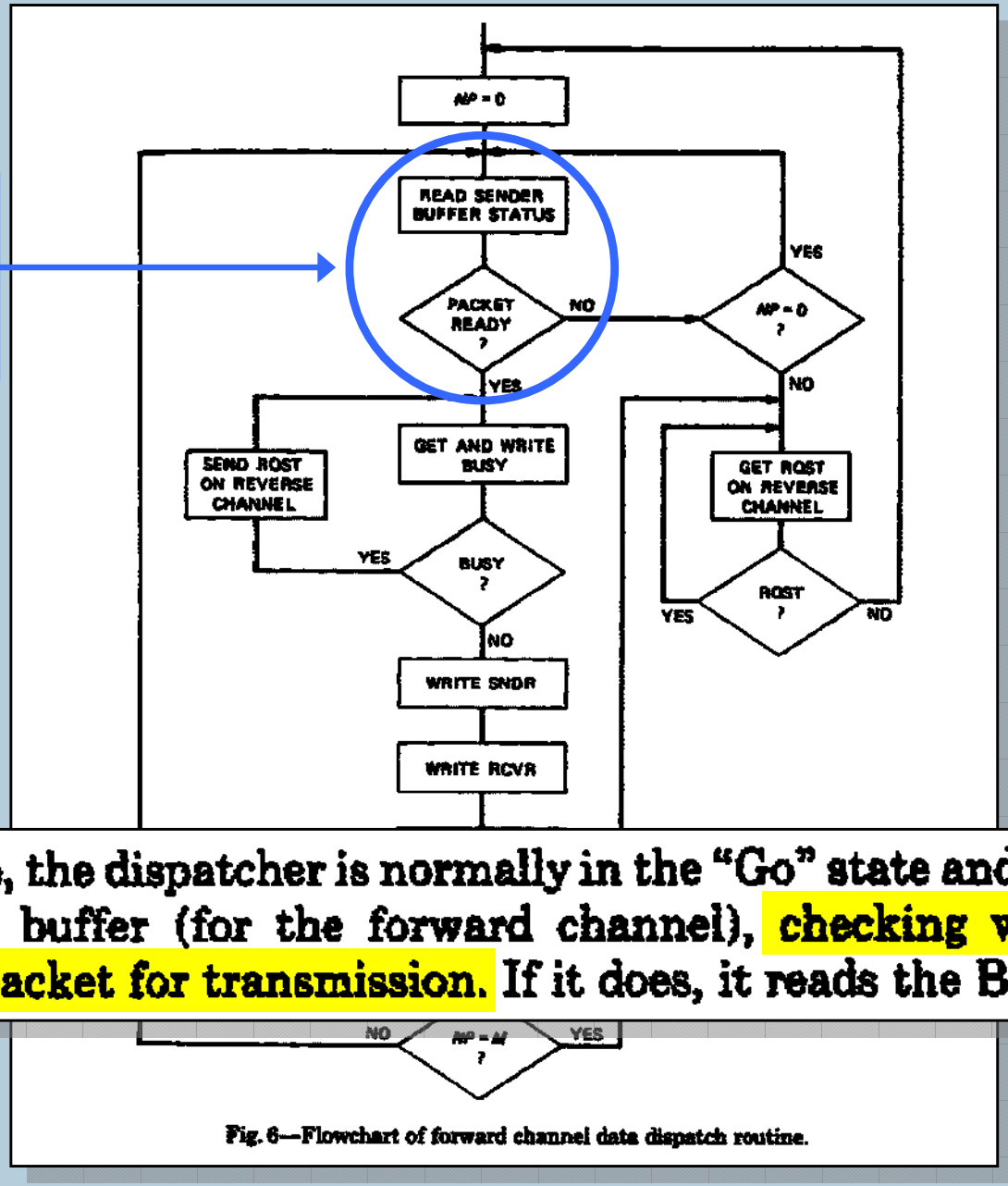


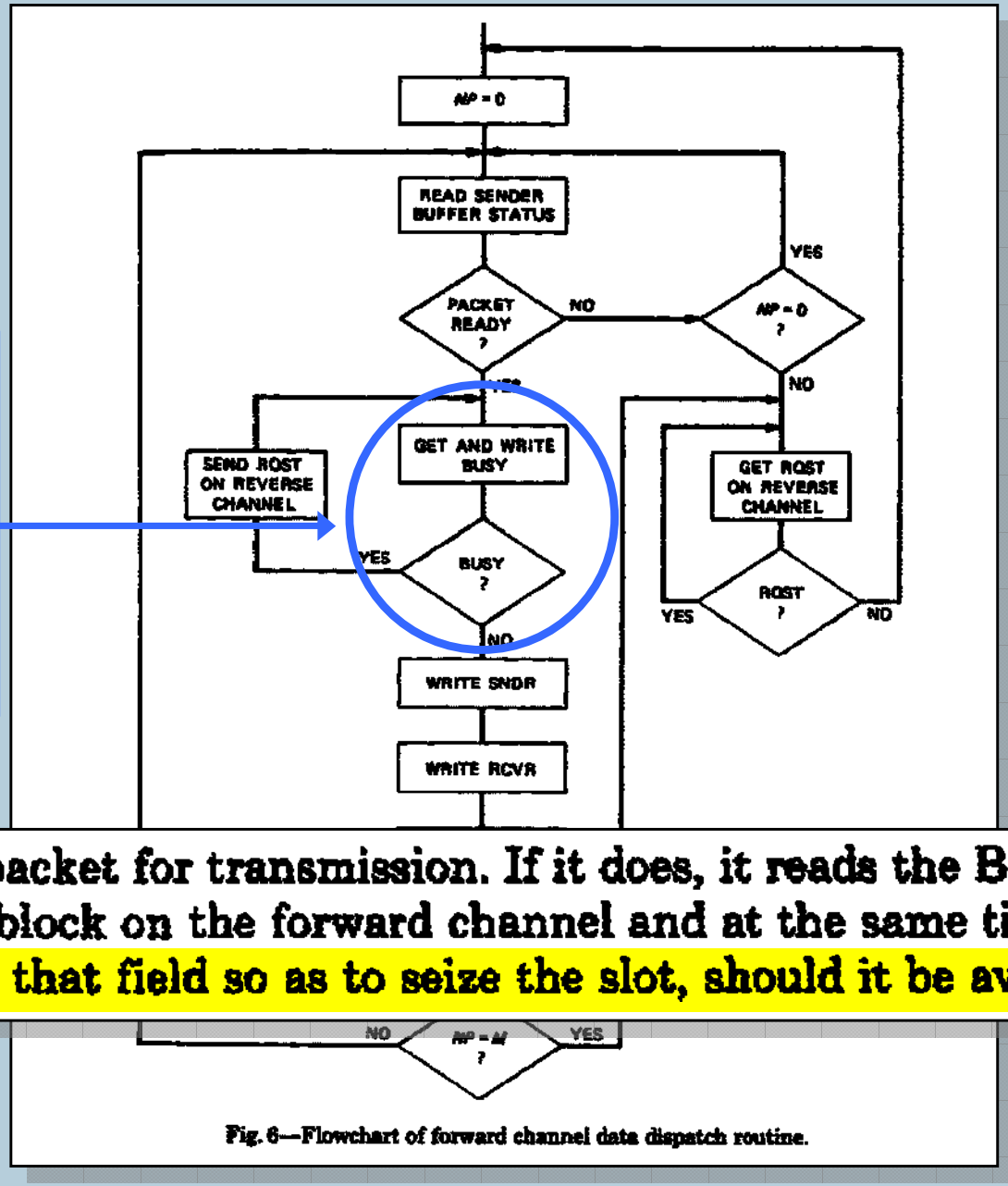
Fig. 6—Flowchart of forward channel data dispatch routine.

When idle, the dispatcher is normally in the "Go" state and monitors the sending buffer (for the forward channel), checking whether it contains a packet for transmission. If it does, it reads the BUSY field

DTX 2056

Budrikis

Check BUSY field of frame to see if payload is empty; if empty, "seize" by writing a ONE



contains a packet for transmission. If it does, it reads the BUSY field of the next block on the forward channel and at the same time writes a "ONE" in that field so as to seize the slot, should it be available. If

Fig. 6—Flowchart of forward channel data dispatch routine.

DTX 2056

Budrikis

BUSY field on the forward channel. It will repeat reading and writing of BUSY on the forward channel and sending RQSTs on the reverse channel until a "ZERO" BUSY occurs. It will then write in the related SNDR, RCVR, and DATA fields, so dispatching a packet.

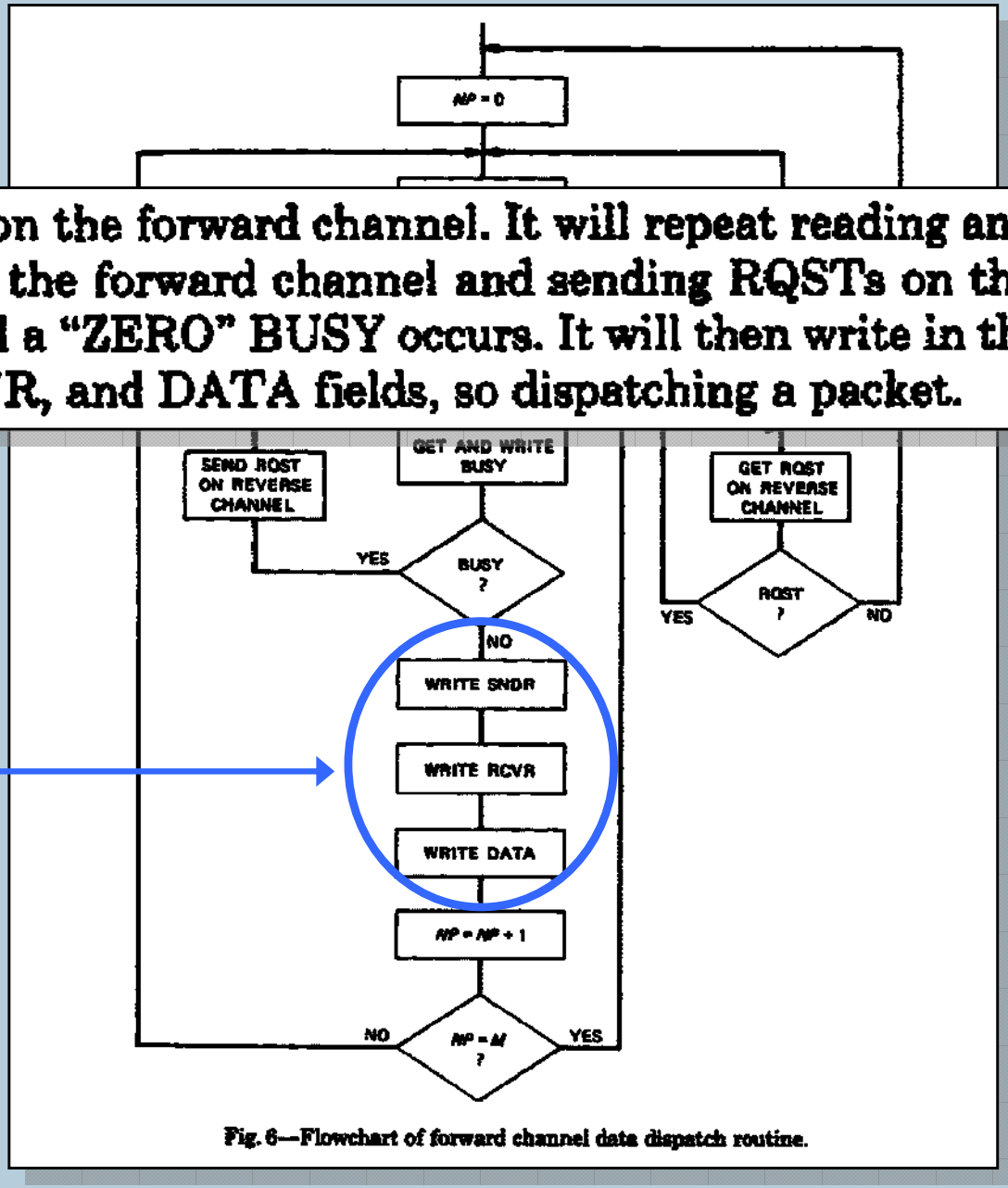
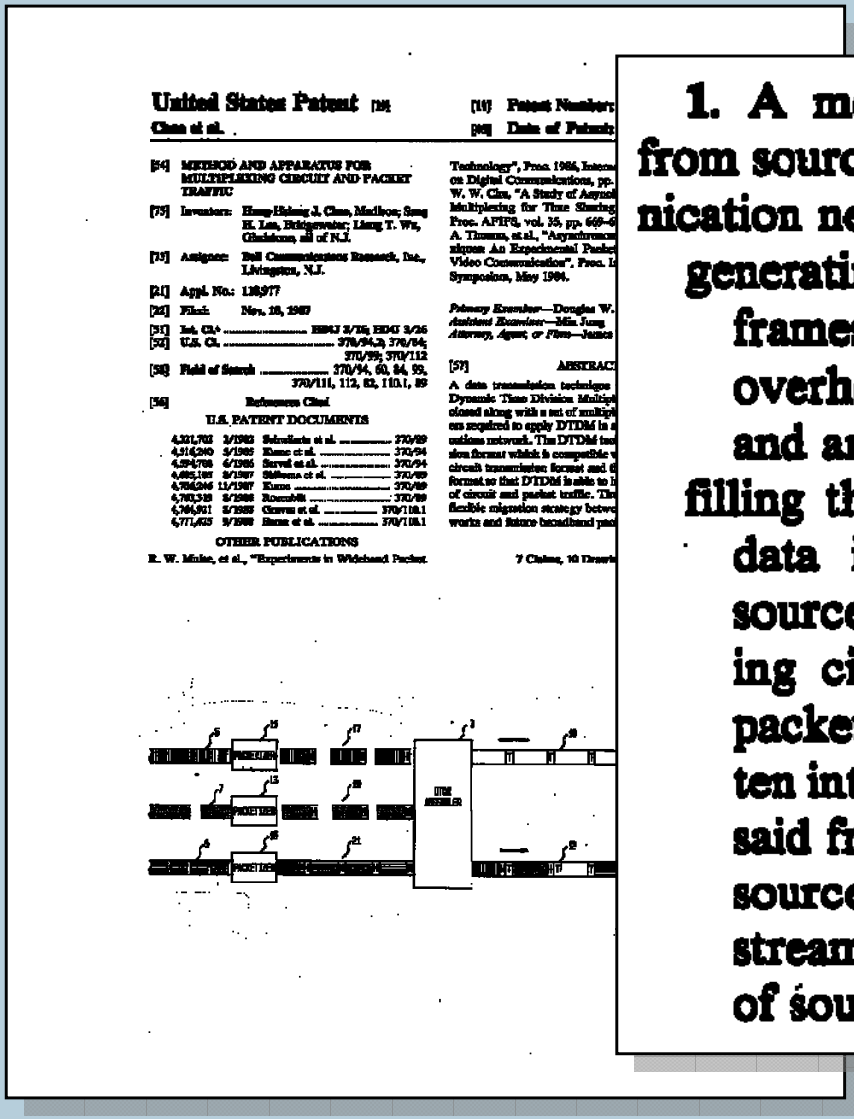


Fig. 6—Flowchart of forward channel data dispatch routine.

Write packet into the payload field

DTX 2056

Claim 1 Of The ’306 Patent



United States Patent [19]

Chen et al.

[54] METHOD AND APPARATUS FOR MULTIPLEXING CIRCUIT AND PACKET TRAFFIC

[75] Inventors: Hung-Hsiang J. Chen, Marlboro; Sung H. Lee, Bridgewater; Liang T. Wu, Gladstone, all of N.J.

[73] Assignee: Bell Communications Research, Inc., Livingston, N.J.

[21] Appl. No.: 128,977

[22] Filed: Nov. 18, 1987

[51] Int. Cl.[4] H04J 3/16; H04J 3/26

[52] U.S. Cl. 370/94.3; 370/94; 370/99; 370/112

[58] Field of Search 370/94, 60, 84, 99, 370/111, 112, 82, 110.1, 85

[56] References Cited

U.S. PATENT DOCUMENTS

4,321,701 3/1982 Schwartz et al. 370/89
4,514,840 4/1985 Kunz et al. 370/94
4,594,708 6/1986 Servel et al. 370/94
4,685,102 8/1987 Shibuya et al. 370/89
4,704,246 11/1987 Kunz 370/89
4,703,318 8/1988 Rocchetti 370/89
4,766,591 8/1988 Graves et al. 370/110.1
4,771,425 9/1988 Baran et al. 370/110.1

OTHER PUBLICATIONS

R. W. Muise, et al., "Experiments in Wideband Packet Technology", Proc. 1988, International Zurich Seminar on Digital Communications, pp. ...

W. W. Chu, "A Study of Asynchronous Time Division Multiplexing for Time Sharing Computer Systems", Proc. AFIPS, vol. 35, pp. 669-...

A. Thomas, et al., "Asynchronous Time-Division Techniques: An Experimental Packet Network Integrating Video Communication", Proc. International Zurich Seminar, Symposium, May 1984.

Primary Examiner—Douglas W. ...
Assistant Examiner—Min Jung
Attorney, Agent, or Firm—James ...

[57] ABSTRACT

A data transmission technique ... Dynamic Time Division Multiplexing ... closed ring with a set of multiplexers ... are required to apply DTDM ... nations network. The DTDM technique ... slow format which is compatible ... circuit transmission format and ... format so that DTDM is able to ... of circuit and packet traffic. The ... flexible migration strategy between ... works and future broadband ...

7 Claims, 10 Drawing ...

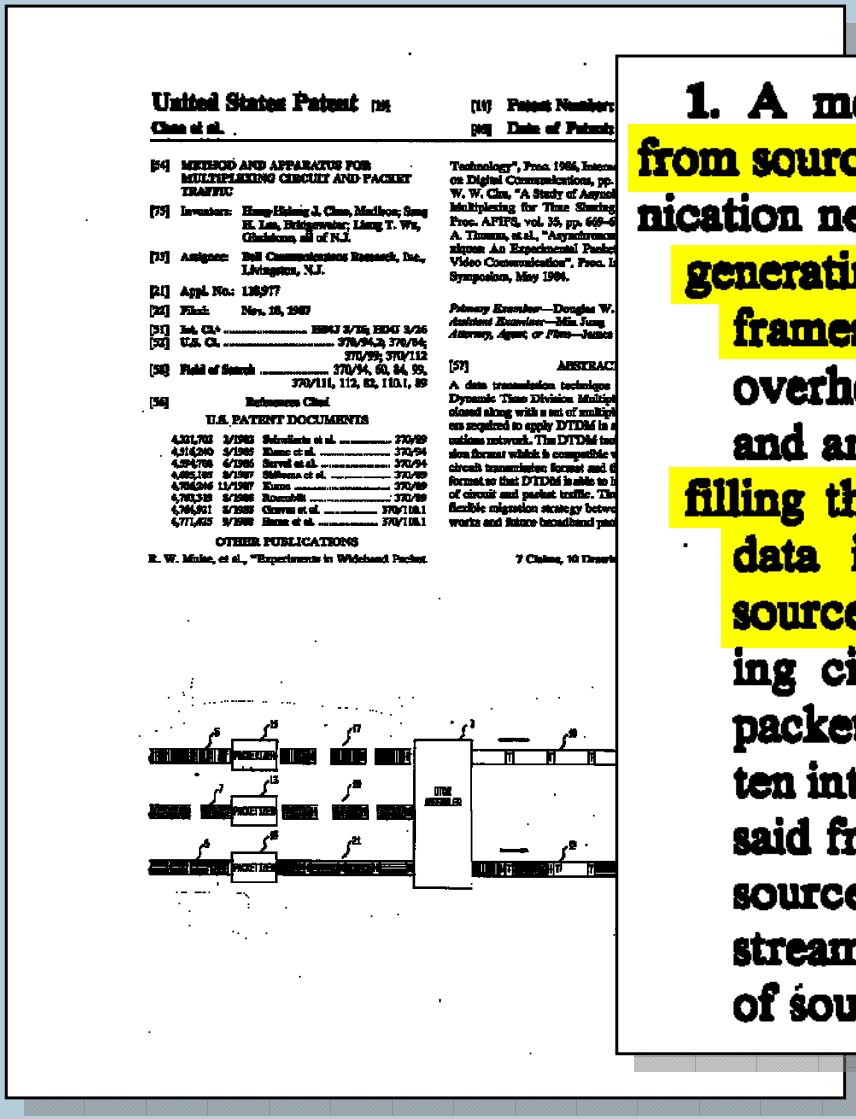
1. A method for simultaneously transmitting data from sources having different bit rates in a telecommunication network comprising the steps of:

generating a bit stream comprising a sequence of frames, each of said frames including a transmission overhead field containing frame timing information and an empty payload field, and

filling the empty payload fields in said frames with data in packetized format from a plurality of sources which have access to the bit stream including circuit or packet sources, such that data in packetized format from any of said sources is written into any available empty payload field of any of said frames for transmitting data from each of said sources at its own desired bit rate via said bit stream and for transmitting data from said plurality of sources simultaneously via said bit stream.

DTX 2002

Budrikis Teaches Each Element Of Claim 1 Of The '306 Patent



United States Patent [19]

Chen et al.

[54] METHOD AND APPARATUS FOR MULTIPLEXING CIRCUIT AND PACKET TRAFFIC

[75] Inventors: Hung-Hsiang J. Chen, Marlboro; Sung H. Lee, Bridgewater; Liang T. Wu, Gladstone, all of N.J.

[73] Assignee: Bell Communications Research, Inc., Livingston, N.J.

[21] Appl. No.: 138,977

[22] Filed: Nov. 18, 1987

[51] Int. Cl.[4] H04J 3/16; H04J 3/26

[52] U.S. Cl. 370/94.3; 370/94; 370/99; 370/112

[58] Field of Search 370/94, 60, 84, 99, 370/111, 112, 62, 110.1, 85

[56] References Cited

U.S. PATENT DOCUMENTS

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4,704,246 11/1987 Kunz 370/89
4,703,318 8/1988 Rocchetti 370/89
4,766,591 8/1988 Chown et al. 370/110.1
4,771,425 9/1988 Baran et al. 370/110.1

OTHER PUBLICATIONS

R. W. Muise, et al., "Experiments in Wideband Packet Technology", Proc. 1988, International Zurich Seminar on Digital Communications, pp. W. W. Chu, "A Study of Asynchronous Time Division Multiplexing for Time Sharing Computer Systems", Proc. AFIPS, vol. 35, pp. 669-678. A. Thomas, et al., "Asynchronous Time Division Techniques: An Experimental Packet Network Integrating Video Communication", Proc. International Zurich Seminar on Digital Communications, Symposium, May 1984.

Primary Examiner—Douglas W. Olms
Assistant Examiner—Min Jung
Attorney, Agent, or Firm—James W. Falk

[57] ABSTRACT

A data transmission technique for Dynamic Time Division Multiplexing a closed ring with a set of multiplexers as required to apply DTDM in a wideband communications network. The DTDM technique uses a frame format which is compatible with both circuit transmission format and packet format so that DTDM is able to handle both types of circuit and packet traffic. The flexible migration strategy between present and future broadband packet networks and future broadband packet

7 Claims, 10 Drawing Sheets

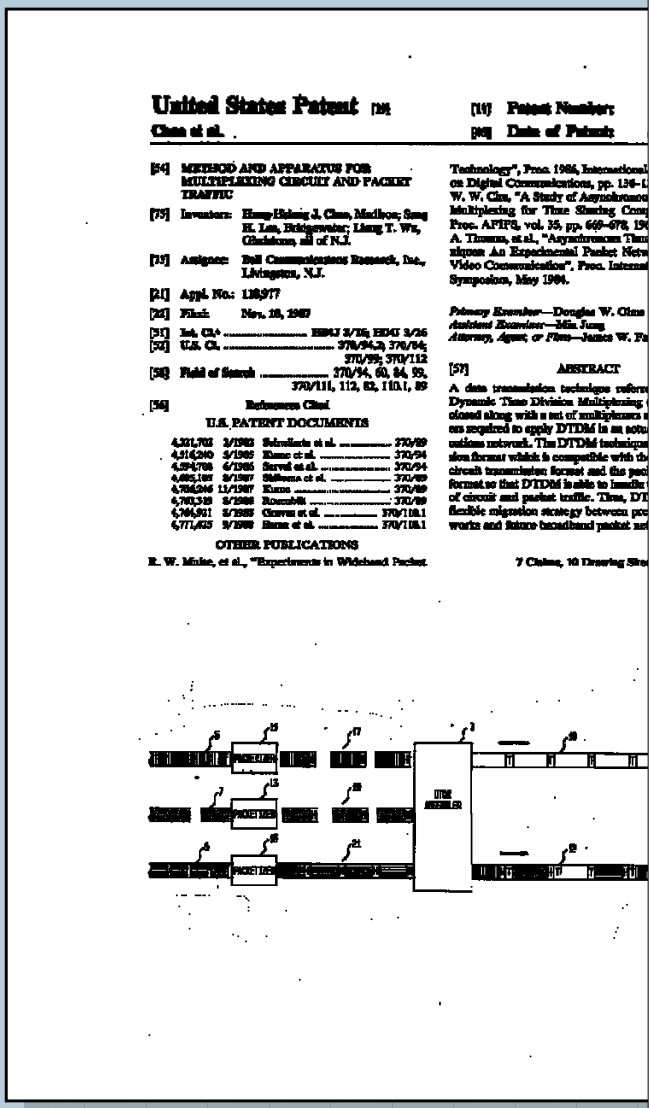
1. A method for simultaneously transmitting data from sources having different bit rates in a telecommunication network comprising the steps of:

generating a bit stream comprising a sequence of frames, each of said frames including a transmission overhead field containing frame timing information and an empty payload field, and

filling the empty payload fields in said frames with data in packetized format from a plurality of sources which have access to the bit stream including circuit or packet sources, such that data in packetized format from any of said sources is written into any available empty payload field of any of said frames for transmitting data from each of said sources at its own desired bit rate via said bit stream and for transmitting data from said plurality of sources simultaneously via said bit stream.

DTX 2002

Budrikis Discloses Each Element Of Claim 3 Of The '306 Patent



United States Patent [19]

Chen et al.

[11] Patent Number:

[45] Date of Patent:

[54] METHOD AND APPARATUS FOR MULTIPLEXING CIRCUIT AND PACKET TRAFFIC

[75] Inventors: Hung-Hsiang J. Chen, Marlboro; Sung H. Lee, Bridgewater; Liang T. Wu, Gladstone, all of N.J.

[73] Assignee: Bell Communications Research, Inc., Livingston, N.J.

[21] Appl. No.: 128,977

[22] Filed: Nov. 18, 1987

[51] Int. Cl.[4] H04J 3/16; H04J 3/26

[52] U.S. Cl. 370/94.3; 370/94; 370/99; 370/112

[58] Field of Search 370/94, 60, 84, 99, 370/111, 112, 82, 110.1, 89

[56] References Cited

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4,685,102 8/1987 Shibuya et al. 370/89
4,704,246 11/1987 Kunz 370/89
4,703,321 8/1988 Rosenthal 370/89
4,744,501 5/1988 Citron et al. 370/110.1
4,771,425 9/1988 Baran et al. 370/110.1

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R. W. Muise, et al., "Experiments in Wideband Packet Technology", Proc. 1988, International Symposium on Digital Communications, pp. 136-1
W. W. Chu, "A Study of Asynchronous Time Multiplexing for Time Sharing Computer Systems", Proc. AFIPS, vol. 35, pp. 669-678, 19
A. Thomas, et al., "Asynchronous Time Sharing Techniques An Experimental Packet Network Integrating Video Communication", Proc. International Symposium, May 1984.

Primary Examiner—Douglas W. Olms
Assistant Examiner—Min Jung
Attorney, Agent, or Firm—James W. Fa

[57] ABSTRACT

A data transmission technique referred to as Dynamic Time Division Multiplexing (DTDM) is disclosed along with a set of multiplexers and switches required to apply DTDM in an asynchronous network. The DTDM technique employs a slot format which is compatible with the circuit transmission format and the packet format so that DTDM is able to handle both types of circuit and packet traffic. Thus, DTDM provides a flexible migration strategy between present networks and future broadband packet networks.

7 Claims, 10 Drawing Sheets

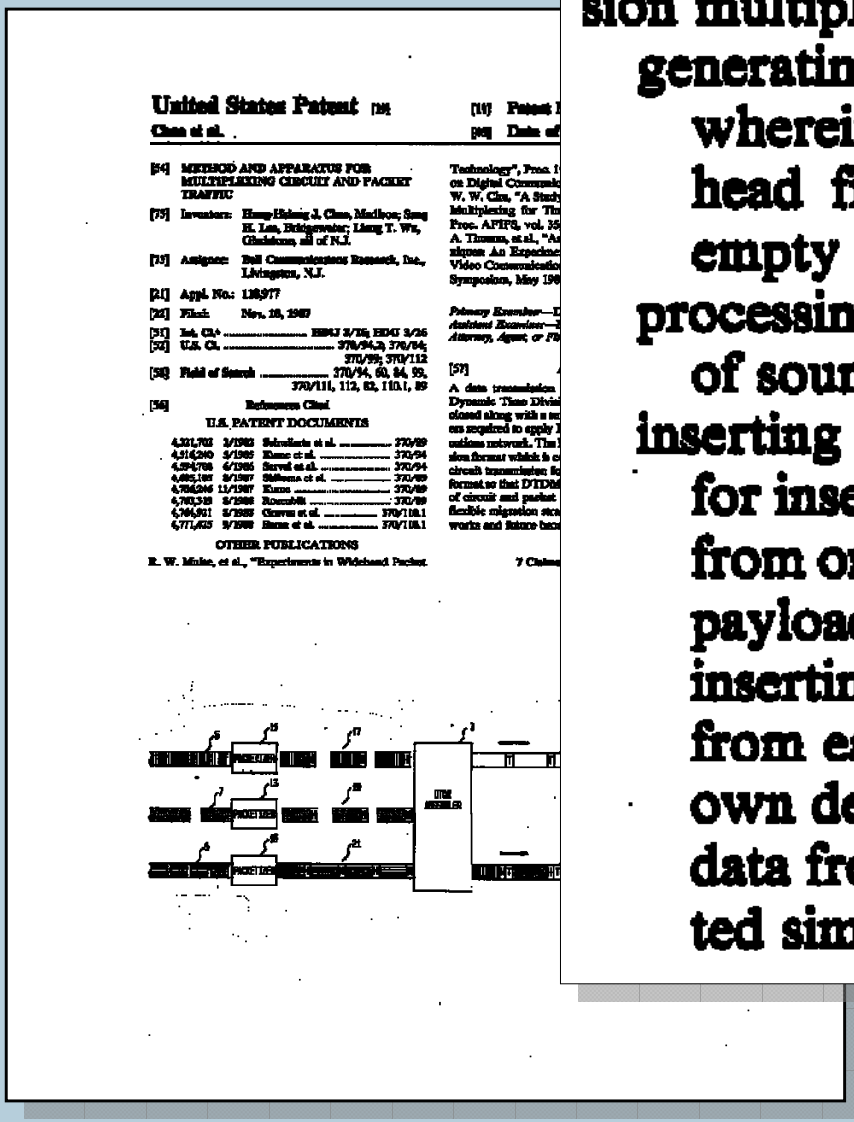
3. A method for generating a bit stream capable of transporting data originating from both circuit transmission and packet sources comprising

generating a bit stream comprising a sequence of frames, each of said frames including a transmission overhead field containing frame timing information and an empty payload field,

packetizing data from a plurality of sources having different bit rates and which have access to said bit stream including circuit transmission sources or customer premises equipment to produce data packets, and

inserting said packets from said sources into the empty payload fields of said frames such that a packet from any of said sources is inserted into any available empty payload field of any of said frames for transmitting data from each of said sources at its own desired bit rate via said bit stream and for transmitting data from said plurality of sources simultaneously using said bit stream.

Budrikis Discloses Each Element Of Claim 4 Of The '306 Patent



United States Patent [19]

Chen et al.

[54] METHOD AND APPARATUS FOR MULTIPLEXING CIRCUIT AND PACKET TRAFFIC

[75] Inventors: Hung-Hsiang J. Chen, Marlboro; Sung H. Lee, Bridgewater; Liang T. Wu, Gladstone, all of N.J.

[73] Assignee: Bell Communications Research, Inc., Livingston, N.J.

[21] Appl. No.: 128,977

[22] Filed: Nov. 18, 1987

[51] Int. Cl.[4] H04J 3/16; H04J 3/26

[52] U.S. Cl. 370/94.3; 370/94; 370/99; 370/112

[58] Field of Search 370/94, 60, 84, 99, 370/111, 112, 82, 110.1, 89

[56] References Cited

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4,321,701 3/1982 Schwartz et al. 370/89
4,414,660 8/1983 Kunz et al. 370/94
4,494,708 6/1985 Szeto et al. 370/94
4,685,107 8/1987 Shibuya et al. 370/89
4,704,246 11/1987 Kunz 370/89
4,703,321 8/1988 Rosenthal 370/89
4,706,081 8/1988 Cowen et al. 370/110.1
4,771,425 9/1988 Baran et al. 370/110.1

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R. W. Muise, et al., "Experiments in Wideband Packet Technology", Proc. 1 on Digital Communi W. W. Cim, "A Study Multiplexing for Th Proc. APIPS, vol. 35 A. Thiana, et al., "A nique: An Experime Video Communicatio Symposium, May 198

Primary Examiner—I Assistant Examiner— Attorney, Agent, or Fi

[57] A data transmission Dynamic Time Divi closed ring with a n ers required to apply I nations network. The I sion format which h circuit transmission fo format so that DTDM of circuit and packet flexible migration sta works and future bro

7 Claim

4. An apparatus for assembling a dynamic time division multiplexing bit stream comprising,

generating means for generating a train of frames wherein each frame includes a transmission overhead field containing timing information and an empty payload field,

processing means for processing data from a plurality of sources into packet format, and

inserting means for receiving said train of frames and for inserting each of said packets comprised of data from one of said plurality of sources into any empty payload field of any of said frames available to said inserting means to form said bit stream so that data from each of said sources can be transmitted at its own desired bit rate via said bit stream and so that data from said plurality of sources can be transmitted simultaneously via said bit stream.

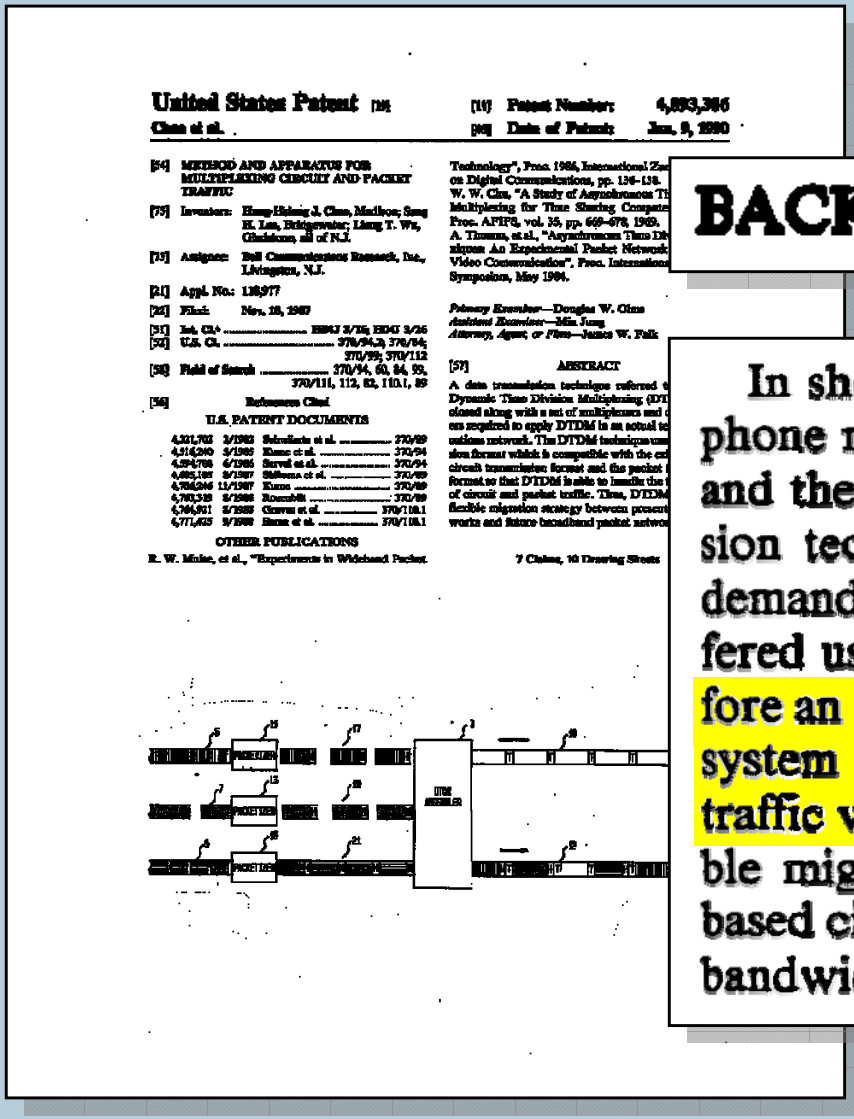
Budrikis Discloses Claim 4

An AU acts as an agent of a client station (St) (e.g., telephone, facsimile terminal, computer) and mediates communications between it and other stations by way of corresponding AUs. Communications are carried on by write-and-reads in memory/time slots of uniform length and format. Each slot consists of a data field and several control fields. Collectively, the control fields provide synchronization, "Slot

All elements of our proposal are well established and tried. Central,

Obviousness

’306 Patent: Integration Of Circuit And Packet Switching



United States Patent [19]

Chen et al.

[11] Patent Number: 4,893,306

[45] Date of Patent: Jan. 9, 1990

[54] METHOD AND APPARATUS FOR MULTIPLEXING CIRCUIT AND PACKET TRAFFIC

[75] Inventors: Hung-Hsiang J. Chen, Marlboro; Sung H. Lee, Bridgewater; Liang T. Wu, Gladstone, all of N.J.

[73] Assignee: Bell Communications Research, Inc., Livingston, N.J.

[21] Appl. No.: 138,977

[22] Filed: Nov. 18, 1987

[51] Int. Cl.[4] H04J 3/16; H04J 3/26

[52] U.S. Cl. 370/94.3; 370/94; 370/99; 370/112

[58] Field of Search 370/94, 60, 94, 99, 370/111, 112, 82, 110.1, 85

[56] References Cited

U.S. PATENT DOCUMENTS

OTHER PUBLICATIONS

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W. W. Chu, "A Study of Asynchronous Ti... Multiplexing for Time Sharing Computer... Proc. AFIPS, vol. 35, pp. 669-678, 1969.

A. Thomas, et al., "Asynchronous Time Di... nique: An Experimental Packet Network... Video Communication", Proc. International... Symposium, May 1984.

Primary Examiner—Douglas W. Olms
Assistant Examiner—Min Jung
Attorney, Agent, or Firm—James W. Falk

[57] ABSTRACT

A data transmission technique referred t... Dynamic Time Division Multiplexing (DT... closed ring with a set of multiplexers and d... ers required to apply DTDM is an actual te... nations network. The DTDM technique use... slot format which is compatible with the ex... circuit transmission format and the packet ... format so that DTDM is able to handle the t... of circuit and packet traffic. Thus, DTDM... flexible migration strategy between present... works and future broadband packet netwo...

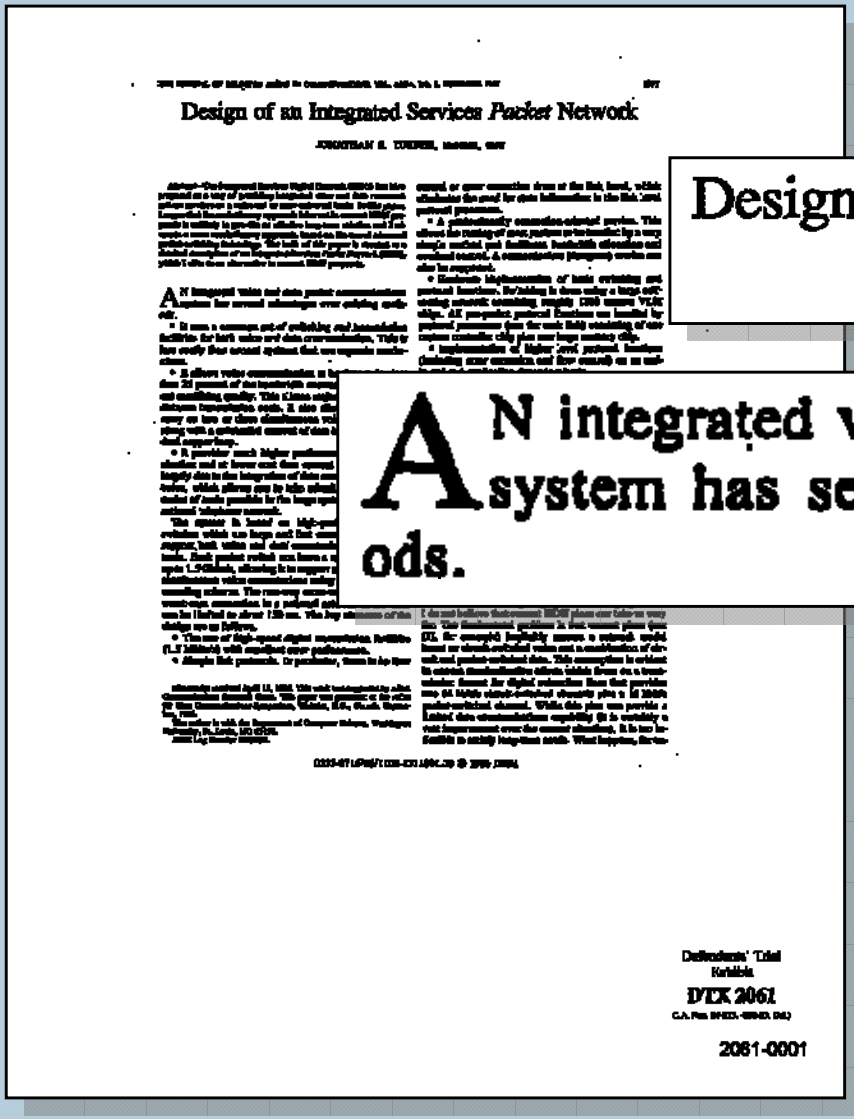
7 Claims, 10 Drawing Sheets

BACKGROUND OF THE INVENTION

In short, the situation is that the present public telephone network utilizes circuit transmission technology and the associated time division multiplexing transmission techniques, while future broadband services, the demand for which is presently uncertain, are best offered using packet transmission technology. It is therefore an object of the invention to provide a transmission system which is capable of integrating present circuit traffic with future packet traffic so as to provide a flexible migration strategy from the existing copper wire based circuit network to succeeding generations of high bandwidth packet transmission networks.

DTX 2002

Widespread Interest In Integration Of Circuit And Packet Switching


Design of an Integrated Services *Packet* Network

JONATHAN S. TURNER, MEMBER, IEEE

AN integrated voice and data packet communications system has several advantages over existing methods.

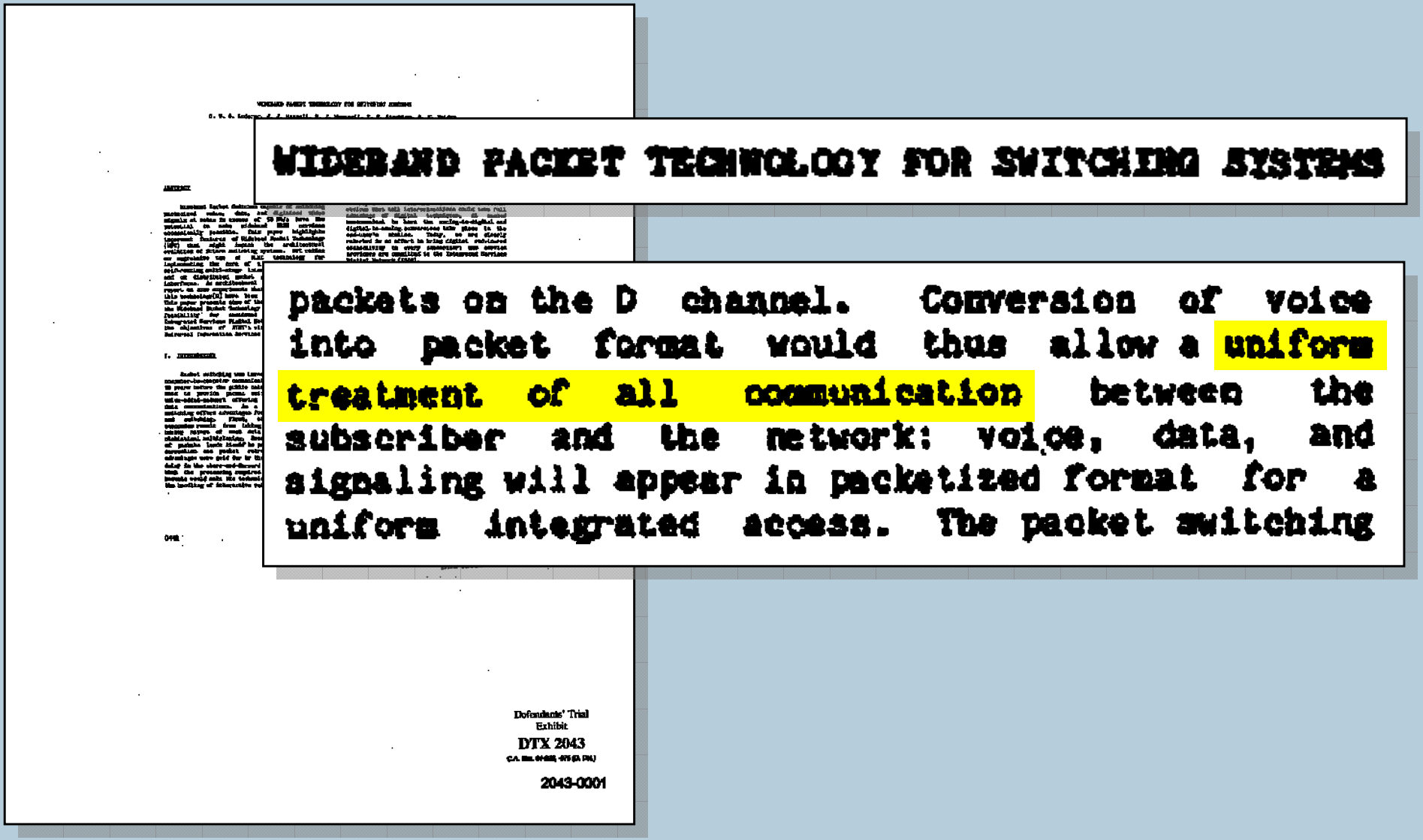
Defendants' Trial Exhibits

DTX 2061

2061-0001

DTX 2061

Widespread Interest In Integration Of Circuit And Packet Switching



WIDEBAND PACKET TECHNOLOGY FOR SWITCHING SYSTEMS

packets on the D channel. Conversion of voice into packet format would thus allow a uniform treatment of all communication between the subscriber and the network: voice, data, and signaling will appear in packetized format for a uniform integrated access. The packet switching

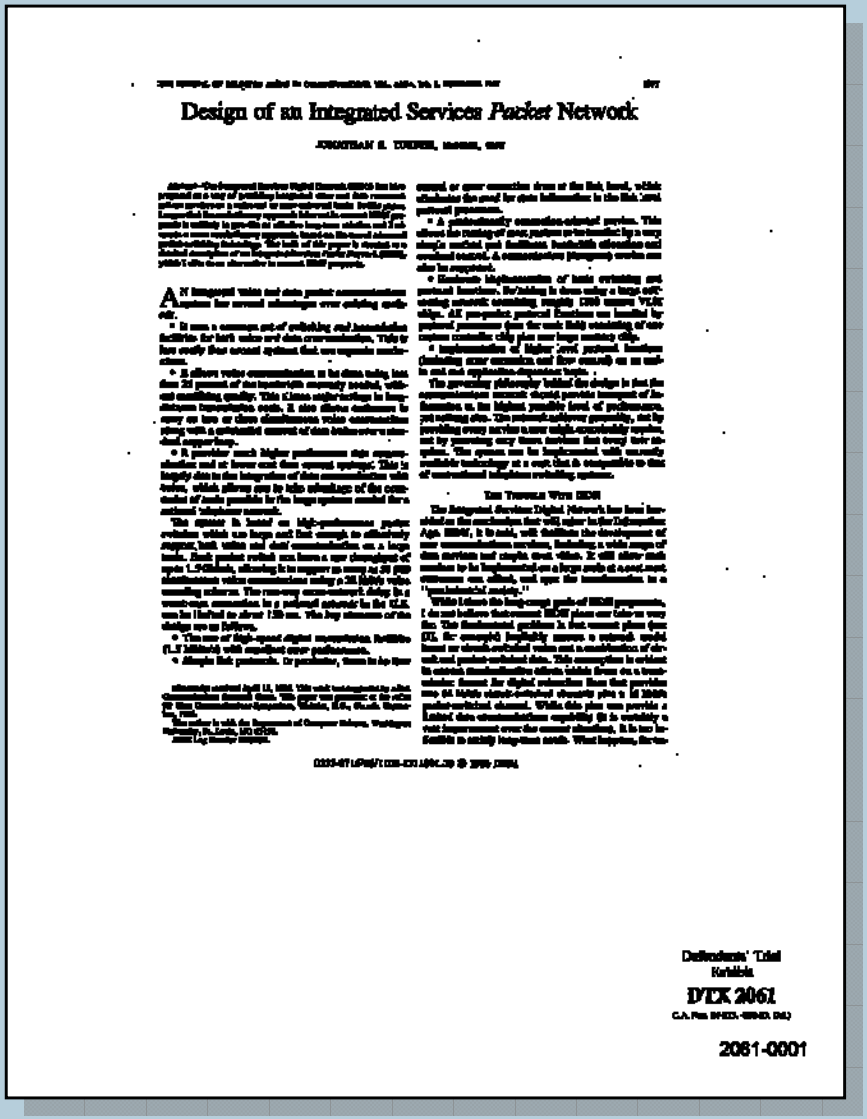
Defendants' Trial Exhibit

DTX 2043

2043-0001

DTX 2043

Turner



Design of an Integrated Services *Packet* Network

Defendants' Trial Exhibit

DTX 2061

2061-0001

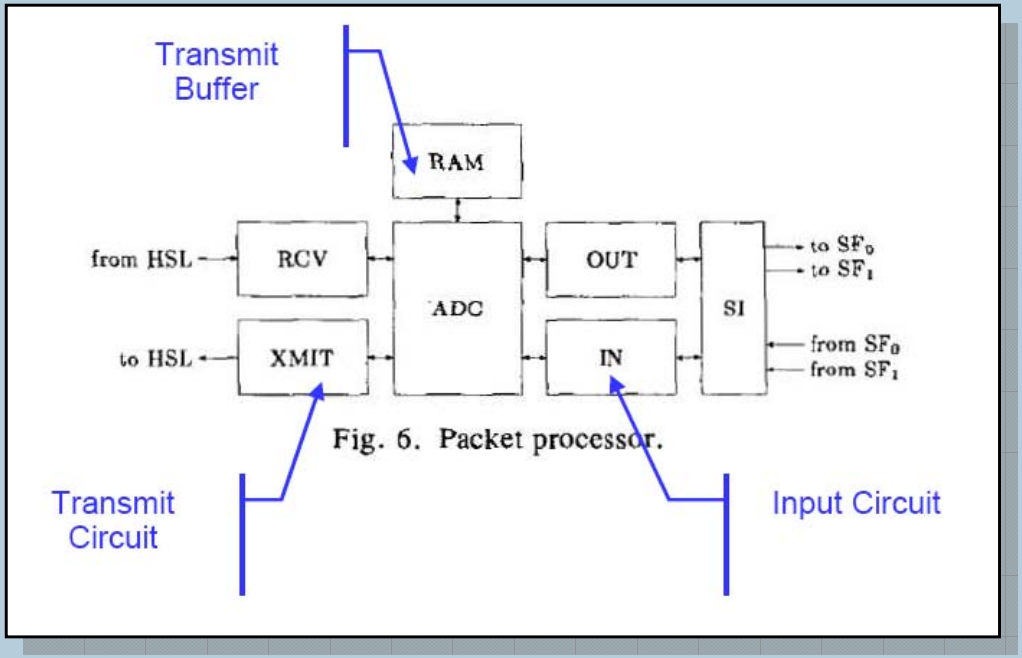


Fig. 6. Packet processor.

DTX 2061

Takeuchi

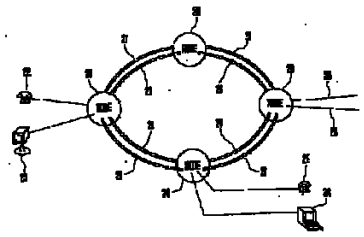
INTEGRATED CIRCUIT/PACKET SWITCHING SYSTEM

Inventors: Takao Takeuchi; Takehiko Yamaguchi, both of Tokyo, Japan

Assignee: NEC Corporation, Tokyo, Japan

Appl. No.: 589,566

Filed: Mar. 14, 1984



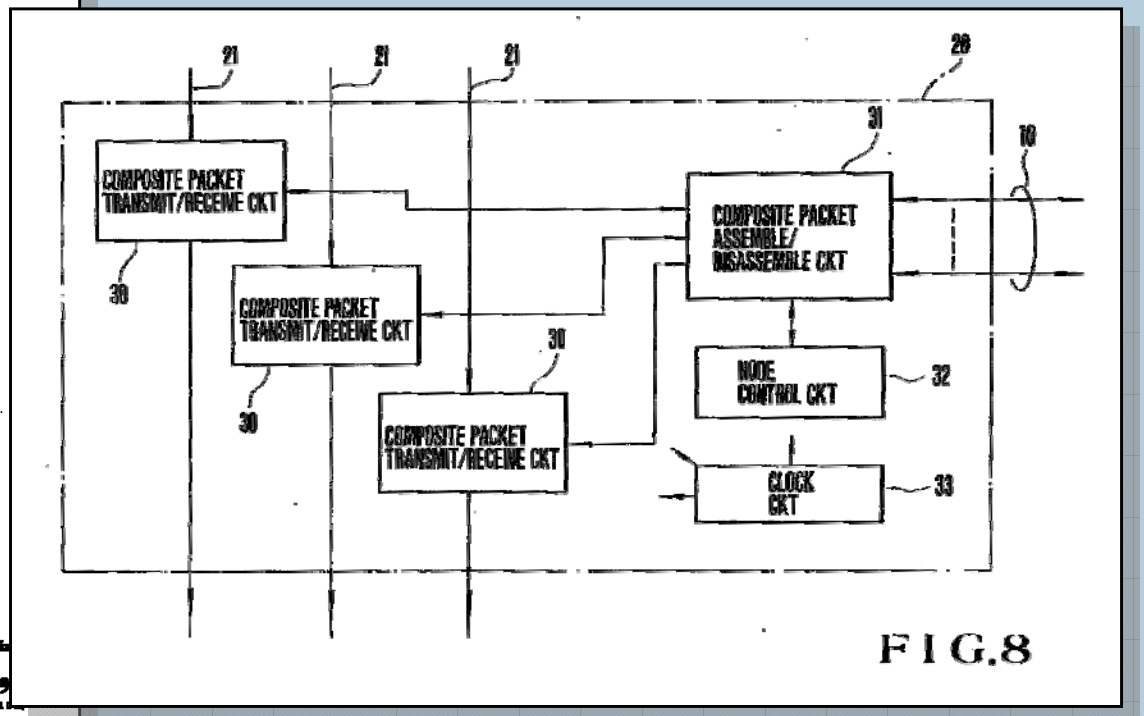


FIG.8

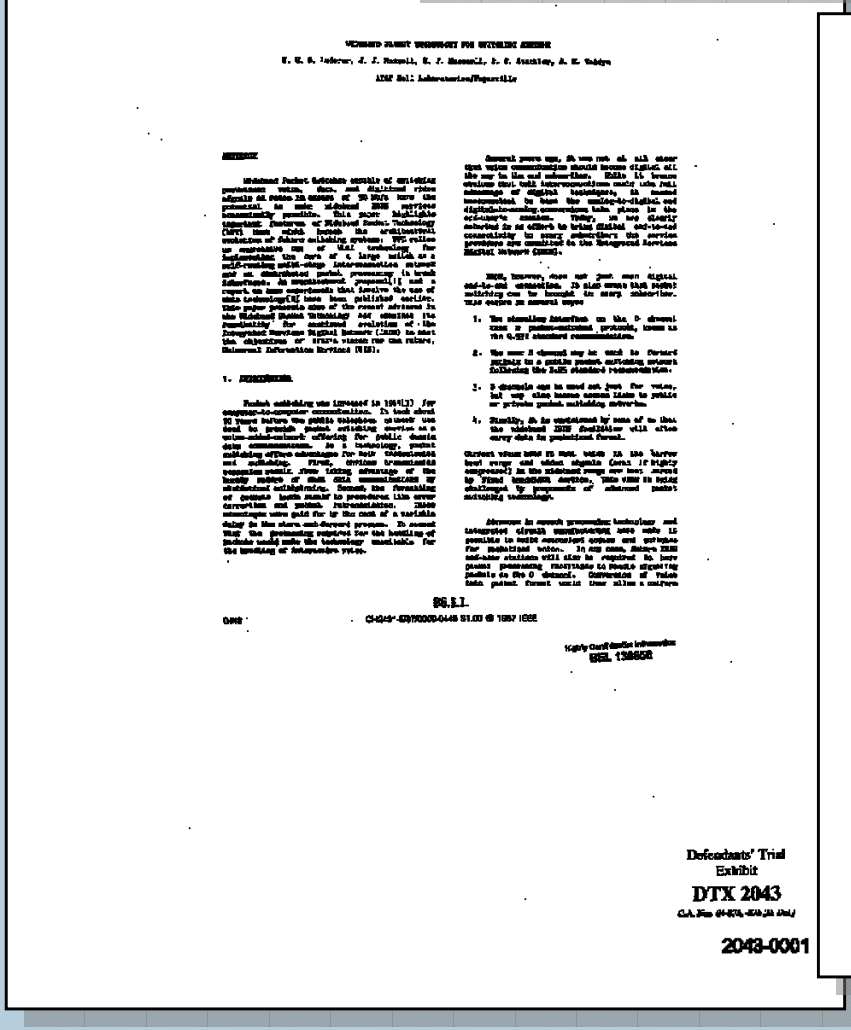
Defendants' Trial Exhibit:
DTX 2019
C.A. No. 04-876-GMS

2019-0001

DTX 2019

Luderer

WIDEBAND PACKET TECHNOLOGY FOR SWITCHING SYSTEMS



Defendants' Trial Exhibit
DTX 2043
2043-0001

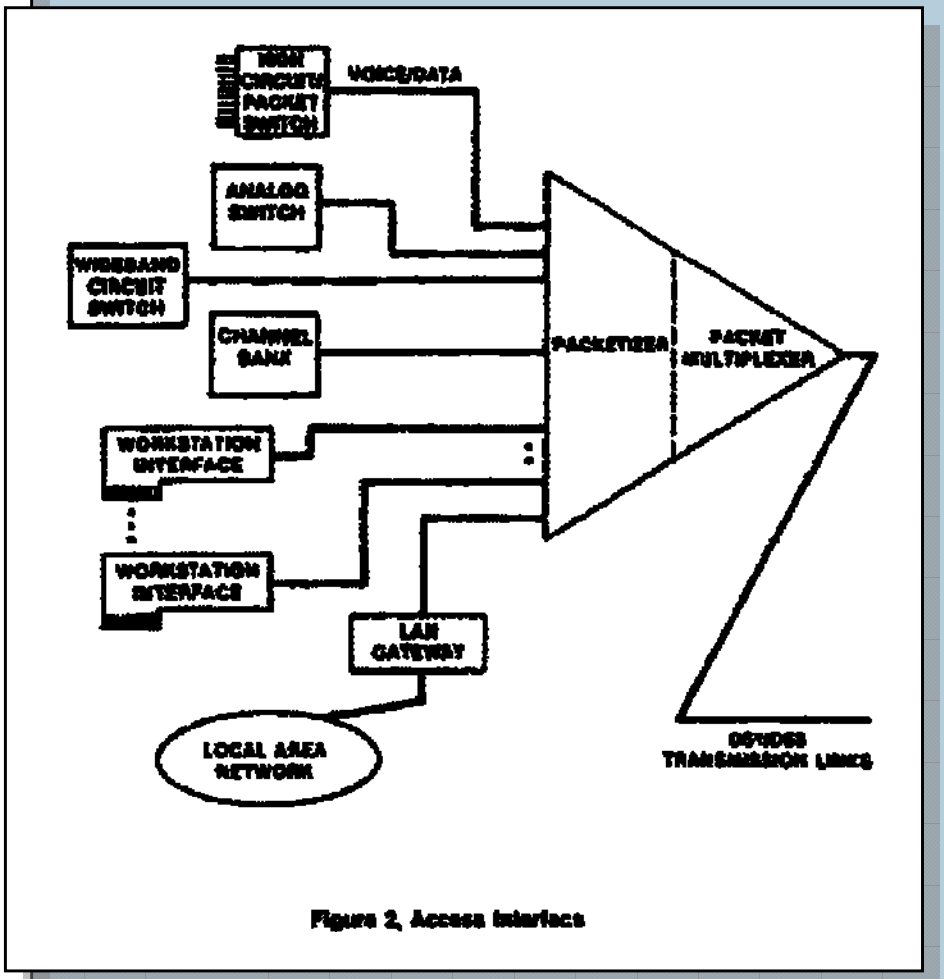


Figure 2. Access Interface

DTX 2043

Baran

Synchronous packet voice/data communications system.

[redacted]

(11) EP 0 176 679 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: 13.05.92

(21) Application number: 85106702.5

(22) Date of filing: 30.05.85

(54) Synchronous packet voice/data communications system.

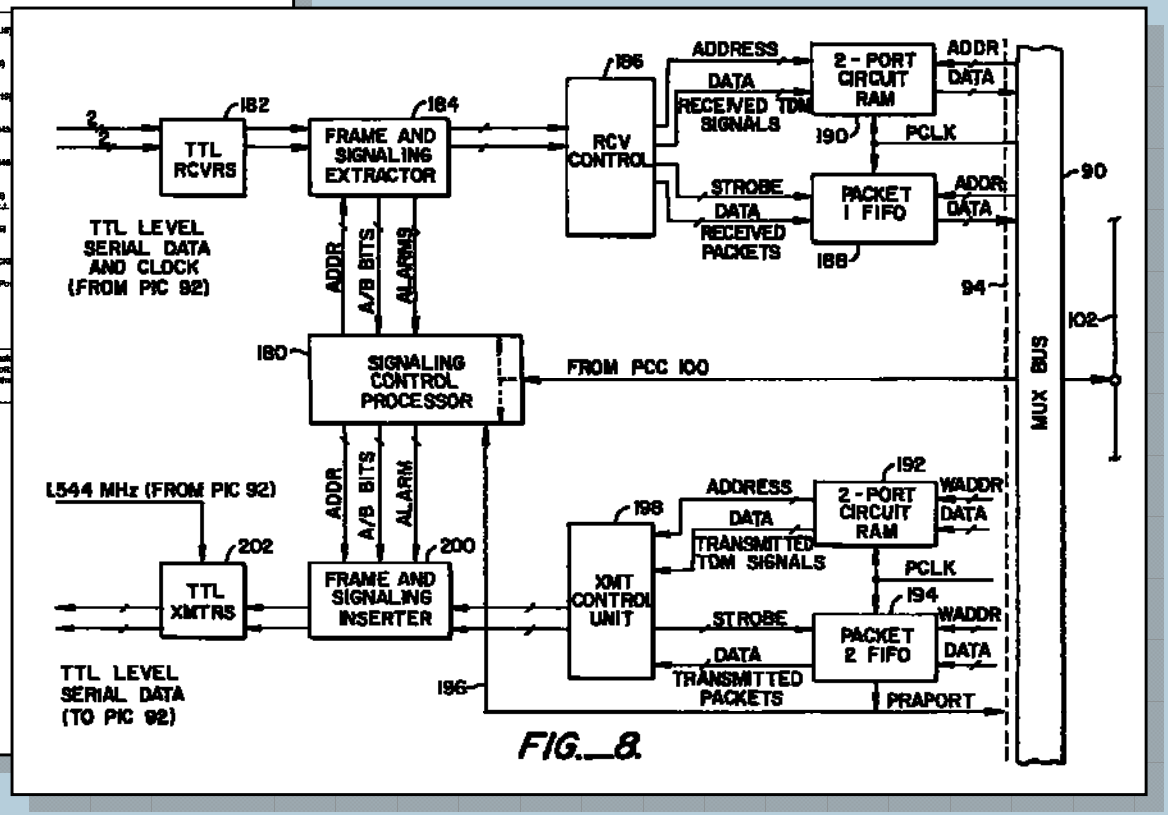


FIG. 8

DTX 2023

EXHIBIT 6

6 of 13 DOCUMENTS

Analysis
As of: May 31, 2007

CORDIS CORP., Plaintiff, v. MEDTRONIC AVE, INC., BOSTON SCIENTIFIC CORP. and SCIMED LIFE SYSTEMS, INC. Defendants. MEDTRONIC AVE, INC., Plaintiff, v. CORDIS CORP., et al. Defendants. BOSTON SCIENTIFIC CORP., Plaintiff, v. ETHICON, INC., et al. Defendants. CORDIS CORP., Plaintiff, v. BOSTON SCIENTIFIC CORP., et al., Defendants.

Civ. No. 97-550-SLR, Civ. No. 97-700-SLR, Civ. No. 98-019-SLR, Civ. No. 98-197-SLR

UNITED STATES DISTRICT COURT FOR THE DISTRICT OF DELAWARE

2005 U.S. Dist. LEXIS 2260

January 27, 2005, Decided

SUBSEQUENT HISTORY: Motions ruled upon by *Cordis Corp. v. Medtronic Vascular, Inc., 2005 U.S. Dist. LEXIS 6583 (D. Del., Feb. 28, 2005)*

PRIOR HISTORY: *Cordis Corp. v. Medtronic Ave, Inc., 336 F. Supp. 2d 363, 2004 U.S. Dist. LEXIS 19174 (D. Del., 2004)*

DISPOSITION: Plaintiff's motion for summary judgment was denied.

CASE SUMMARY:

PROCEDURAL POSTURE: Plaintiff patentee alleged that defendants infringed its United States Patent Nos. 4,739,762 ('762 patent) and 5,195,984 ('984 patent). The United States Court of Appeals for the Federal Circuit reversed the district court's original claim construction and remanded. Accordingly, the court reconstrued the claims. The patentee moved for summary judgment on the grounds that defendants waived arguments regarding the obviousness of these patents.

OVERVIEW: The patentee contended that defendants waived any arguments that the '762 and '984 patents were obvious in light of the prior art because they failed to assert this argument at trial with respect to the '762 patent and because the jury found the '984 patent nonobvious. The patentee based its argument on the fact that the differences between the claim construction at trial and the revised claim construction were not substantive. However, the consideration of obviousness changed as a result of the revised claim construction. The elimination of the requirements that slots be formed by removing material and that the stents be uniformly thick within .001 inches, broadened the claims and increased the number of pertinent prior art references. These prior art references were not relevant in the context of the previous, narrower constructions and, therefore, defendants were not required to assert them in the previous trials. With respect to invalidity, it was the prior art and its relationship to the claim language that mattered.

OUTCOME: The district court denied the motion for summary judgment. Because the court found genuine issues of fact in dispute, the court awarded the costs of briefing to defendants.

LexisNexis(R) Headnotes

Civil Procedure > Discovery > Methods > General Overview
Civil Procedure > Summary Judgment > Standards > Genuine Disputes
Civil Procedure > Summary Judgment > Standards > Materiality
[HN1] A court shall grant summary judgment only if the pleadings, depositions, answers to interrogatories, and admissions on file, together with the affidavits, if any, show that there is no genuine issue as to any material fact and that the moving party is entitled to judgment as a matter of law. Fed. R. Civ. P. 56(c).

Civil Procedure > Summary Judgment > Burdens of Production & Proof > Movants
Civil Procedure > Summary Judgment > Standards > Genuine Disputes
[HN2] In a motion for summary judgment, the moving party bears the burden of proving that no genuine issue of material fact exists.

Civil Procedure > Summary Judgment > Standards > Genuine Disputes
[HN3] In a motion for summary judgment, facts that could alter the outcome are "material," and disputes are "genuine" if evidence exists from which a rational person could conclude that the position of the person with the burden of proof on the disputed issue is correct.

Civil Procedure > Summary Judgment > Standards > Genuine Disputes
Civil Procedure > Summary Judgment > Standards > Materiality
[HN4] In a motion for summary judgment, if the moving party has demonstrated an absence of material fact, the nonmoving party then must come forward with specific facts showing that there is a genuine issue for trial.

Civil Procedure > Summary Judgment > Evidence
Civil Procedure > Summary Judgment > Motions for Summary Judgment > General Overview
Civil Procedure > Summary Judgment > Opposition > General Overview
[HN5] In a motion for summary judgment, a court will view the underlying facts and all reasonable inferences therefrom in the light most favorable to the party opposing the motion. The mere existence of some evidence in support of the nonmoving party, however, will not be sufficient for denial of a motion for summary judgment; there must be enough evidence to enable a jury reasonably to find for the nonmoving party on that issue. If the nonmoving party fails to make a sufficient showing on an essential element of its case with respect to which it has the burden of proof, the moving party is entitled to judgment as a matter of law.

Patent Law > Infringement Actions > Claim Interpretation > General Overview
Patent Law > Nonobviousness > Evidence & Procedure > General Overview
[HN6] The consideration of obviousness changes as a result of a revised claim construction.

Patent Law > Infringement Actions > Doctrine of Equivalents > General Overview
Patent Law > Nonobviousness > Elements & Tests > Prior Art
[HN7] Prior art can be used as a defense to infringement under the doctrine of equivalents because the doctrine cannot be used to encompass prior art within asserted claims.

Patent Law > Infringement Actions > Defenses > Patent Invalidity > Grounds
Patent Law > Nonobviousness > Elements & Tests > Prior Art
[HN8] Prior art is relevant to literal infringement only to the extent that it affects the construction of ambiguous claims. Infringers cannot use "practicing prior art" as a defense to literal infringement because they are not free to flout the requirement of proving invalidity by clear and convincing evidence by asserting a "practicing prior art" defense to literal infringement under the less stringent preponderance of the evidence standard.

Civil Procedure > Pleading & Practice > Defenses, Demurrers, & Objections > Waiver & Preservation
Patent Law > Infringement Actions > Claim Interpretation > Scope
Patent Law > Infringement Actions > Defenses > Patent Invalidity > Grounds
[HN9] With respect to invalidity, it is the prior art and its

relationship to the claim language that matters.

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JUDGES: ROBINSON, Chief Judge.

OPINION BY: ROBINSON

OPINION:

MEMORANDUM OPINION

Dated: January 27, 2005
Wilmington, **[*2]** Delaware

ROBINSON, Chief Judge

I. INTRODUCTION

These cases have a long and complicated history, only the relevant parts of which will be discussed here. In the fall of 2000, a jury trial was held to decide issues of infringement and damages. The jury found that Medtronic's stents infringed, under the doctrine of equivalents, the asserted claims of *United States Patent Nos. 4,739,762* ("the '762 patent") and 5,195,984 ("the '984 patent"). The district court granted JMOL of noninfringement, finding that Cordis was estopped from asserting infringement under the doctrine of equivalents. Cordis appealed the JMOL decisions to the Federal Circuit. The Federal Circuit reversed this court's original claim construction and remanded the case for further proceedings. *Cordis Corp. v. Medtronic AVE, Inc., 339 F.3d 1352 (Fed. Cir. 2003)*. On February 17, 2004, this court reconstrued the relevant limitations of the asserted claims. (D.I. 1201)

Before the court is Cordis' motion for summary judgment that defendants waived arguments regarding the obviousness of these patents. (D.I. 1258) For the reasons stated, this motion is denied.

II. BACKGROUND [*3]

At the time of the previous trials, the court had construed the "slots formed therein" limitation to mean that the slots be formed in the wall surface of a tubular member, as by the removal of material. (D.I. 790) The "substantially uniform thickness" limitation of the asserted claims was construed to require that the thickness of the stent's wall surface not vary by 0.001 inch or more. (Id.)

In response to the Federal Circuit's opinion reversing certain parts of the claim construction, the court reconstrued the "plurality of slots formed therein" limitation as meaning that "the stent is constructed to contain a plurality of slots in its wall surface." (D.I. 1201 at 5) The "substantially uniform thickness" limitation was reconstrued to mean that the walls "must be of largely or approximately uniform thickness." (D.I. 1251 at 2 n.1)

III. STANDARD OF REVIEW

[HN1] A court shall grant summary judgment only if "the pleadings, depositions, answers to interrogatories, and admissions on file, together with the affidavits, if any, show that there is no genuine issue as to any material fact and that the moving party is entitled to judgment as a matter of law." *Fed. R. Civ. P. 56(c)* **[*4]** . [HN2] The moving party bears the burden of proving that no genuine issue of material fact exists. See *Matsushita Elec. Indus. Co. v. Zenith Radio Corp., 475 U.S. 574, 586 n.10, 89 L. Ed. 2d 538, 106 S. Ct. 1348 (1986)*. [HN3] "Facts that

could alter the outcome are 'material,' and disputes are 'genuine' if evidence exists from which a rational person could conclude that the position of the person with the burden of proof on the disputed issue is correct." *Horowitz v. Fed. Kemper Life Assurance Co., 57 F.3d 300, 302 n.1 (3d Cir. 1995)* (internal citations omitted). [HN4] If the moving party has demonstrated an absence of material fact, the nonmoving party then "must come forward with 'specific facts showing that there is a genuine issue for trial.'" *Matsushita, 475 U.S. at 587* (quoting *Fed. R. Civ. P. 56(e)*). [HN5] The court will "view the underlying facts and all reasonable inferences therefrom in the light most favorable to the party opposing the motion." *Pa. Coal Ass'n v. Babbitt, 63 F.3d 231, 236 (3d Cir. 1995)*. The mere existence of some evidence in support of the nonmoving party, however, will not be sufficient for denial of a motion **[*5]** for summary judgment; there must be enough evidence to enable a jury reasonably to find for the nonmoving party on that issue. See *Anderson v. Liberty Lobby, Inc., 477 U.S. 242, 249, 91 L. Ed. 2d 202, 106 S. Ct. 2505 (1986)*. If the nonmoving party fails to make a sufficient showing on an essential element of its case with respect to which it has the burden of proof, the moving party is entitled to judgment as a matter of law. See *Celotex Corp. v. Catrett, 477 U.S. 317, 322, 91 L. Ed. 2d 265, 106 S. Ct. 2548 (1986)*.

IV. DISCUSSION

A. Waiver

Cordis contends that Medtronic and BSC waived any arguments that the *'762* and '984 patents are obviousness in light of the prior art because they failed to assert this argument at trial with respect to the *'762 patent* and because the jury found the '984 patent nonobvious. Cordis' argument is based on its view that the differences between the claim construction at trial and the revised claim construction are not substantive. Medtronic and BSC contend that the trial should not have any preclusive effect with respect to their arguments under the new claim construction.

[HN6] The consideration of obviousness changed as a result of the revised claim construction. See, e. **[*6]** g., *TI Group Automotive, Sys. v. VDO N. Am., LLC, 375 F.3d 1126, 1139-40 (Fed. Cir. 2004)*. The elimination of the requirements that slots be formed by removing material and that the stents be uniformly thick within .001 inches, broadens the claims and increases the number of pertinent prior art references. (D.I. 1275 at 5-6; D.I. 1277, Ex. A at PP 13-19, Ex. G at P 9, Ex. I at 159, Ex. J at 411, 530). These prior art references were not relevant in the context of the previous, narrower constructions and, therefore, defendants were not required to assert them in the previous trials.

Cordis also contends that Medtronic had the opportunity to argue that the claims, as currently construed, were obvious as a noninfringement defense under *Wilson Sporting Goods Co. v. David Geoffrey & Associates, 904 F.2d 677, 685 (Fed. Cir. 1990)*. In Wilson Sporting Goods, the alleged infringer argued that its accused products were not different from the prior art, thus, they could not be considered infringing products under the doctrine of equivalents (i.e., "practicing the prior art defense"). Id. The Federal Circuit agreed, finding that [HN7] prior art can be used as **[*7]** a defense to infringement under the doctrine of equivalents because the doctrine cannot be used to encompass prior art within asserted claims. *Id. at 683-85*.

The Federal Circuit has taken a narrow view of Wilson Sporting Goods and refused to extend it to claims of literal infringement, explaining that [HN8] "prior art is relevant to literal infringement only to the extent that it affects the construction of ambiguous claims." *Tate Access Floors, Inc. v. Interface Architectural Res., Inc., 279 F.3d 1357, 1367 (Fed. Cir. 2002)*. In Tate Access Floors, the Federal Circuit reasoned that infringers could not use "practicing prior art" as a defense to literal infringement because they "are not free to flout the requirement of proving invalidity by clear and convincing evidence by asserting a 'practicing prior art' defense to literal infringement under the less stringent preponderance of the evidence standard." Id.

In the original trial against Medtronic, Cordis argued that Medtronic infringed the *'762* and '984 patents under the doctrine of equivalents. Pursuant to *Wilson Sporting Goods*, Medtronic could have asserted a "practicing prior art" defense. **[*8]** This does not mean, however, that because it did not assert such a defense it has waived its ability to bring an invalidity argument. [HN9] With respect to invalidity, "it is the prior art and its relationship to the claim language that matters." *Tate Access Floors, 279 F.3d at 1367*. In this case, in order to assert the Wilson Sporting Goods defense in the prior trial, Medtronic would have had to present to the jury a

broader claim construction than that ordered by the court. Both the court and Cordis, one suspects, would have objected on the grounds, inter alia, of jury confusion. Therefore, it is unrealistic to have expected Medtronic to present invalidity arguments in the original trial if it thought such arguments were futile based on the narrower claim construction at issue. See *Exxon Chem. Patents, Inc. v. Lubrizol Corp., 137 F.3d 1475, 1479 (Fed. Cir. 1998)*. It would be unfair to hold Medtronic to this broader claim construction now.

B. Costs And Fees

Medtronic requested that the court award it the costs and fees associated with responding to Cordis' motion for summary judgment. On September 22, 2004, the court stated that Cordis would **[*9]** pay the costs of briefing if the court found that there were genuine issues of disputed facts with respect to Cordis' summary judgment motions. (D.I. 1253 at 17) Having now found genuine issues of fact in dispute, the court awards the costs of briefing to Medtronic.

V. CONCLUSION

For the reasons stated, Cordis' motion for summary judgment that Medtronic and BSC waived their obviousness defenses (D.I. 1258) is denied. As directed by the court, Cordis shall pay the reasonable costs of briefing incurred by Medtronic. An order consistent with this memorandum opinion shall issue.